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ABSTRACT

This course-outline is intended to assist vocational instructors in developing and teaching a course in the electrical trades. Addressed in the individual sections of the outline are the following topics: orientation (a course overview, job orientation, safety, first aid, and Vocational Industrial Clubs of America); basic skills (mathematics, print reading, and tools and lab procedures); power sources (batteries, special power sources, and generators); residential wiring (rough-in and finish wiring and service equipment); low-voltage remote control circuits; commercial and industrial wiring (electric metallic, rigid conduit, flexible metal conduit, rigid nonmetallic conduit, hydraulic conduit bender, distribution transformers, and bus duct distribution system); single- and three-phase electric motors; motor and static automatic controls; and entrepreneurship (economic systems and going into business). Each major block is divided into a series of minor blocks, which are in turn broken down into individual tasks. Each task section includes a task statement, an instructional aim, cross-referenced information outlines, teaching suggestions, and suggested references and aids. Appendixes to the guide include 35 suggested references and guidelines for developing a functional course of study, a suggested list of items that should be included when writing specific objectives, and a discussion of teaching methods. (MN)

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ELECTRICAL TRADES SUGGESTED BASIC COURSE OUTLINE

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FEDERAL INDUSTRIAL SERVICES
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TEXAS A & M UNIVERSITY

A
SUGGESTED BASIC COURSE OUTLINE
FOR

ELECTRICAL TRADES

PUBLISHED BY



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VOCATIONAL INDUSTRIAL EDUCATION
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FOREWORD

This teacher's guide is one of a series of basic guides for teaching trade and industrial shop subjects in public schools. Each course was developed with the assistance of outstanding trade and industrial teachers from their occupational field, representatives from industry, and reviewed by a select group of teachers and industrial representatives. The development of each basic guide is under the supervision of Trade and Industrial Education staff, Vocational Instructional Services, Texas A&M University in cooperation with the Texas Education Agency.

The purpose of this basic guide:

1. To assist the beginning teacher in selecting the occupational skills and related and technical information and provide a basis upon which the teacher can progressively build a functional course of study in accordance with the training needs of the students and the local community.
2. To assist the teacher in identifying and correlating pertinent technical information.
3. To assist the teacher in determining the time needed to teach each lesson and a basis for the pro-ration of time in the total program.
4. To assist the teacher in the selection of appropriate methods, teaching aids, and references, and supply the teacher with the sources of information, films, references, and aids.
5. To assist the teacher in the development of/or selection of appropriate instructional sheets or materials.
6. To assist in the improvement of communications between the teacher and the student through the use of stated behaviorial objectives (Aims) for each task and to corresponding technical information.
7. To provide interested educational and industrial groups and individuals with information regarding the scope, content, methods and techniques of trade preparatory instruction.
8. To provide local school administrators and boards of education with information that may assist them in selecting and inaugurating trade preparatory programs best suited to the needs of their student bodies.

This guide includes only the basic skills and technical information to be taught and should be supplemented with the other complementary and necessary areas of related instruction. Experiences should be provided for the development of desirable attitudes and appreciations.

TRADE AND INDUSTRIAL EDUCATION

The purpose of trade and industrial education is to develop basic manipulative skills, safety judgements, proper work habits, desirable attitudes and appreciations for the purpose of fitting young persons for initial employment in industrial occupations and of upgrading or retraining workers employed in industry.

Training is provided through practical shop and/or laboratory experiences and other closely related school activities. The local school provides the shops or laboratories, tools, equipment and materials which are comparable to those used in industry. Each student enrolled receives two/three hours of instruction each day which is centered around the performance of useful or productive jobs and activities and taught by a teacher who is experienced and competent in the occupation.

COURSE OBJECTIVES

This outline is designed with the intention of providing students with an opportunity to develop skills, knowledge, attitudes, and leadership, after having the instruction provided by a competent electrical trades teacher.

The students will be able to:

1. Perform the basic manipulative skills involved in the occupation.
2. Make application and use of the underlying theories, technical information, and related occupational information to assure sound judgements, decisions and proper procedures involved in the occupation.
3. Appreciate and respect the employer-employee relationship, and have an awareness of the necessity of delivering worthy service for value received.
4. Develop a sense of personal integrity and confidence in their ability to earn their rightful place in the community.
5. Practice those qualities of citizenship which will lead the way toward a happy and productive life.
6. Gain employment in the occupation for which training was given.
7. Gain skills related to leadership.
8. Develop those concepts and skills as identified by the essential elements listed in chapter 75 of the Texas Administration code, State Board of Education Rules for Curriculum (see page iii).

STATE BOARD OF EDUCATION RULES FOR CURRICULUM
CHAPTER 75

VOCATIONAL EDUCATION

S75.81 Essential Elements Common to All Programs

(a) The elements in this subsection are common to all vocational programs and shall be included in each addressed course at the appropriate level. They are described here to preclude repetition in each course description. Every school offering vocational education shall provide courses which include the following essential elements:

- (1) **Leadership concepts and skills.** The student shall be provided opportunities to:
 - (A) identify characteristics and responsibilities of leaders and effective group members;
 - (B) participate in orderly meetings conducted according to parliamentary procedure (optional in occupational orientation);
 - (C) function effectively on committees (optional in occupational orientation);
 - (D) plan and conduct leadership activities; and
 - (E) prepare for effective citizenship and participation in our democratic society.
- (2) **Concepts and skills related to successful employment.** The student shall be provided opportunities to:
 - (A) develop an awareness of employment opportunities in chosen field;
 - (B) practice correct procedures for job application and interview;
 - (C) develop the ability to take and follow both oral and written directions;
 - (D) practice punctuality and dependability;
 - (E) observe rules and standards of the work place;
 - (F) demonstrate an ability to work with others harmoniously;
 - (G) develop responsibility and the ability to follow through on assigned tasks; and
 - (H) exhibit productive work habits and attitudes.

- (3) Concepts and skills associated with entrepreneurship. The student shall be provided opportunities to:
 - (A) recognize opportunities and options for business ownership;
 - (B) identify entry-level procedures, planning processes, and terms needed to open a business; and
 - (C) develop an understanding of the role of small business in the free enterprise system.
- (b) Objectives for these elements must be modified to suit the needs and abilities of individual handicapped students, disadvantaged students, and those with limited English proficiency.
- (c) Individual course descriptions are given for occupations identified by specific six-digit instructional codes. Whether students receive instruction for an identified occupation through a pre-employment laboratory program or through cooperative training they must receive the essential elements specified in appropriate sections. Only those occupational training areas in which enrollment totals at least one percent of total program enrollment are described. Such individual course descriptions are found in agribusiness education, health occupations education, marketing and distributive education, occupational home economics education, office education, technical education, and industrial education.

TRADE AND INDUSTRIAL EDUCATION

S75.91 Trade and Industrial Education

- (a) Trade and industrial education (2-3 units) shall include the following essential elements:
 - (1) Concepts and skills associated with safe working practices. The student shall be provided opportunities to:
 - (A) identify safe working practices;
 - (B) understand safe working practices;
 - (C) demonstrate skills in working safely; and
 - (D) apply safe working practices to all job-training situations.
 - (2) Care and use of hand tools and equipment. The student shall be provided opportunities to develop proper techniques for the use, maintenance, and storage of tools and equipment related to vocational industrial education.

- (3) Concepts and skills associated with the specific occupation being taught.**

ELECTRICAL TRADES

- (i) Electrical trades (2-3 units) shall include the essential trade and industrial education elements and the following essential elements:**

- (1) Concepts and skills associated with residential wiring. The student shall be provided opportunities to:**

- (A) develop a basic understanding of the theory of electricity;
- (B) understand the processes of generating and distributing electrical power;
- (C) identify and apply electrical codes regulating residential electrical construction;
- (D) plan and install residential electrical service entrance and individual and general-purpose branch circuits;
- (E) understand and properly install electrical anchoring systems, boxes, meters, controls, and circuit protective devices;
- (F) understand and demonstrate proper techniques in the installation of various cables, switch boxes, and connectors;
- (G) install internal and external lights, controls, and service;
- (H) read blueprints and schematic diagrams;
- (I) estimate labor and material costs; and
- (J) troubleshoot residential electrical problems.

- (2) Concepts and skills associated with industrial wiring. The student shall be provided opportunities to:**

- (A) understand and utilize electric metallic tubing, rigid and flexible conduit on commercial installations;
- (B) service single phase, split phase, capacitor start, and repulsion type motors;
- (C) install and repair three phase motors;

- D) install and repair electric motor controls; and
- E) troubleshoot single phase motors, three phase motors, and motor controls.

ELECTRICAL TRADES

JOB DESCRIPTION

Plans layout and installs and repairs wiring, electrical fixtures, apparatus and control equipment. Plans new or modified installations to minimize waste of materials, provide access for future maintenance, and avoid unsightly, hazardous, and unreliable wiring, consistent with specifications and local electrical code.

Prepares sketches showing location of all wiring and equipment or follow diagrams or blueprints prepared by others, insuring that concealed wiring is installed before completion of future wall, ceilings, and flooring. Measures, cuts, bends, threads, assembles, and installs electrical conduit, using such tools as hacksaw, pipe threader, and conduit bender.

Pulls wiring through conduit, assisted by Electrician Helper. Splices wires by stripping insulation from terminal leads with knife or pliers, twisting or soldering wires together, and applying tape or terminal caps. Connects wiring to lighting fixtures and power equipment, using handtools.

Installs control and distribution apparatus, such as relays, and circuitbreaker panels, fastening them in place with screws or bolts, using drills, masonry chisels, hammers, anchor bolts, and wrenches.

Connects power cables to equipment, such as electric range or motor, and installs grounding leads.

Tests continuity of circuit to insure electrical compatibility and safety of all components, using standard instruments, such as ohmmeter, battery, buzzer and oscilloscope.

Observes functioning of installed equipment or system to detect hazards and need for adjustments, relocation, or replacement. May repair faulty equipment or systems.

May be required to hold license.

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Mr. J. D. Fiorino, Electrical Training Specialist, Texas Engineering and Extension Service,
Texas A&M University.

Mr. Jose A. Rosales, St. Phillips College, San Antonio, Texas.

Mr. Alvin Hancock, St. Phillips College, San Antonio, Texas.

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MAJOR BLOCK I
ORIENTATION

TASK: 1. Introduction to Pre-Employment Class
AIM: The student will be able to describe operating procedures of the Electrical Trades classroom and lab and the skills and competencies they will develop.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Course Overview	<u>Related Knowledge</u> I. Introduction A. Teacher B. Students C. Course II. Philosophy of vocational education III. Instructor's philosophy IV. Course description A. Course objectives B. Scope and content 1. First year 2. Second year C. Method of instruction 1. Lessons 2. Assignments 3. Tests 4. Projects D. Supplementary instruction 1. Films 2. Field trips 3. Guest speakers E. Testing procedure 1. Classroom 2. Laboratory F. Course requirements G. Credits and certificates 1. Competency profile 2. Certificate of completion	Place on chalkboard: course title instructor's name Have students introduce themselves Passout: Course philosophy and objectives Provide: Course description, method of instruction, job description Discuss with class Show samples Discuss: Types of films, field trips, and guest speakers Discuss requirements of the course Discuss the credits to be received, competency profile, and certificate of completion	Instructor prepared Instructor prepared Local school handbook for students Ref. A, "Competency Profile for Electrician" Vocational Instructional Services, Texas A&M University, F.E. Box 182 College Station, TX 77843

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Course Overview</u> (continued) 25	<u>Related Information (cont'd)</u> <u>2</u>		Ref. B, "Certificate of Completion", Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, TX 77843 26

MAJOR BLOCK I
ORIENTATION

TASK: 2. Identify School and Shop Policies and Procedures

AIM: The student will be able to identify policies and procedures and participate in classroom and shop activities within the framework of school and shop regulations.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Course Overview	<u>Related Knowledge</u> I. School policies - Schedules - Attendance and tardies - Conduct and dress - Fire drills - Makeup work - Absences - Disciplinary action - Special activities - Field trips - Leadership meets - UIL activities - Insurance II. Shop policies - Classroom procedures - Textbooks - Reference materials - Assignments - Notebooks, workbooks, and lab manuals - Tests - Classroom ethics - Laboratory - Safety glasses - Behavior - Work stations - Equipment - Duty assignments - Release forms - Tool room procedure - Personal tools	Passout: Rules and regulations Discuss with students Questions and answers Passout: Rules and regulations of classroom and lab Discuss policies Tour lab facilities Passout: Private physician card, and parental permission forms Discuss each and have student fill them out	Local/state school policies Instructor prepared Ref. C, <u>Handbook For Vocational Industrial Education Shop Teachers, Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, TX 77843</u>

MAJOR BLOCK I

ORIENTATION

TASK: 1. The Electrical Trade

AIM: The student will be able to indentify the required skills, educational background, opportunities and training background needed and available in the Electrical Trades.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Job Orientation	<u>Related Knowledge</u> I. Skilled areas A. Apply math B. Read wiring prints C. Estimate costs D. Install service Entrance equipment E. Install wiring F. Connect circuits G. Install switches, boxes, meters, and controls H. Troubleshoot electrical problems I. Install circuit protective devices J. Install lights, and electrical fixtures k. Install electrical metallic conduit L. Troubleshoot and service motors M. Repair and install motors N. Utilize tools and equipment O. Demonstrate safe work habits II. Related technical area A. Theory of electricity B. Generation and distribution of electrical power	Reading assignment Explain Discuss Handout information sheet Review: 1. Essential elements 2. Competency listings Guest speaker	Information sheet: Instructor prepared State Board of Education Rules for Curriculum, Texas Education Agency, 201 East 11th Street, Austin, TX 78701 Sup. Ref. F, <u>Directory of Occupational Titles</u>, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Guest speaker: Personnel Director from Industry, Electrical Contractor, representative from Electrician Apprenticeship Program Sup. Ref. G, <u>Occupational Outlook</u>, Superintendent of Documents, U.S. Government, Printing Office, Washington, D.C. 20402

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Job Orientation</u> (Continued)	<u>Related Knowledge (cont'd)</u> C. Electric codes 1. Local 2. National 3. Safety D. Electrical motors E. Materials, tools, and equipment III. Training opportunities A. Secondary vocational programs B. Post secondary vocational programs C. apprentice program IV. Job opportunities A. Construction 1. Residential 2. Industrial B. Private enterprise V. Working conditions VI. Work attitude A. Attentive B. Pride in work C. Responsible D. Honest E. Cooperative F. Industrious G. Punctual and dependable H. Safety conscious VII. Level of proficiency A. Electrician helper B. Electrician C. Master electrician	Handout: Information sheet	

MAJOR BLOCK I

ORIENTATION

TASK: 2. Responsibility of Work

AIM: The students will be able to identify their responsibility as an electrician and as a productive citizen in the community

MINOR BLOCK B

INFORMATION & TASK DETAIL

SUGGESTIONS FOR TEACHING

REFERENCES AND AIDS

Job Orientation

Related Knowledge

- I. Employer satisfaction
 - A. Conscientious employee
 - B. Productive employee
 - C. Cooperative employee
 - D. Safe employee
 - E. Honest employee
- II. Customer satisfaction
 - A. Quality
 - B. Productivity
 - C. Courtesy and respect for customer
- III. Personal responsibility
- IV. Civic responsibility

Explain or discuss

Information sheet

Guest speaker

Instructor's experience

Sup. Ref. H, Strong, Merle E., Industrial Labor and Community Relations, Delmar Publishers, Mountainview Ave., Albany, N.Y., 12205

Information sheet:
Teacher prepared

Guest speaker: Person from Employment Commission to discuss the employee, job, and community

ORIENTATION

AIM: The student will be able to identify safe working practices, demonstrate skills in working safely, and apply safe working practices as related to the trade.

MINOR BLOCK	C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Safety		<u>Related Knowledge</u> I. Accident statistics A. Injured B. Deaths II. Results of accidents A. Worker 1. Lost income 2. Reduced earning ability 3. Pain and suffering B. Employer 1. Production loss 2. Property damage 3. High insurance rate C. Public 1. Higher priced goods 2. Lost tax revenue 3. Support welfare assistance III. Safety awareness A. Accident causes B. Types of accidents C. Importance of safety IV. General safety A. Safety glasses B. Dress/grooming	Reading assignment Discuss with students: 1. Importance of safety 2. Safety attitude Slides: Prepare students Show slides Read and discuss script with each slide Guest speaker	Sup. Ref. D Slides: Group programmed instruction <u>Accident Cause Slides</u> , color, script, Bureau of Occupational Safety - 3-224, U.S. Department of Labor, Washington, D.C. 20210 Free, borrower pays return postage (Book two months in advance) Guest speaker: optometrist, safety engineer, school nurse, doctor, local fire department

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Safety</u> (continued)	<u>Related Knowledge (cont'd)</u> C. Housekeeping 1. Materials 2. Inflammables 3. Caustics 4. Tools 5. Equipment D. Handicap 1. Under medication 2. Injury 3. Physical E. Handling materials/ equipment V. Attitude and conduct A. Attentive; alert; cooperative B. Respect for safety of self; others C. Safety awareness D. Grooming 1. Dress 2. Personal hygiene VI. Color coding A. Importance B. Traffic lanes C. Housekeeping D. Machine and parts E. First aid F. Safety; caution VII. Tools - hand/power A. Selection/use B. Maintenance C. Safety VIII. Fire safety A. Types of fires B. Causes of fire C. Extinguishers 1. Types	Passout: 1. General safety rules 2. Fire safety procedures 3. Use of fire extinguishers 4. Safety rules for tools- hand/power Oral quiz Written safety test: Suggestion: not less than 50 questions. Student required to pass with 95% correct answers Passout: pamphlets Discuss color dynamics Explain color safety codes	Safety test: Instructor prepared Pamphlets: DuPont Safety Color Code, Pittsburg Paints Color Dynamics

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Safety</u> (continued)	<u>Related Knowledge (cont'd)</u> 2. Location 3. Proper use D. Building exits E. Fire drill procedure IX. Compressed air A. Compressors B. Pressure hoses/nozzles C. Proper use/safety X. Electrical safety A. Grounding 1. Tools/equipment 2. Work tables 3. Wet floors B. Extension cords 1. Proper use/care 2. Inspection C. Overloads D. Conductor/insulators E. Rescue procedures F. First aid XI. Miscellaneous A. Eye and ear protection B. Volatile materials C. Emergency procedures		

ORIENTATION

TASK: 2. Electric Shock and Rescue

AIM: The student will be able to relate the dangerous aspects of working with electricity and describe rescue procedures of a shock victim.

MINOR BLOCK	C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Safety		<u>Related Knowledge</u> I. Electrical accidents in industry A. Over 1,000 deaths a year B. Thousands more injured II. Causes A. Unsafe conditions 1. Damage extension cords 2. Splices in drop cords 3. Poor wiring 4. Short circuit in tools 5. Others B. Unsafe acts 1. Abuse of electrical equipment 2. Overloading circuits 3. Working on live circuits 4. Removing grounding prong 5. Not using safety gear 6. Others III. Shocking facts A. Voltage not as important as current 1. Spark wire in car has 20,000 volts but is not deadly 2. Ampers is rate of current flow	Discussion Display damaged cords Demonstrate safe gear	Sup. Ref. D

MAJOR BLOCK I
ORIENTATION

TASK: 3. Fire Prevention and Control

AIM: The student will be able to describe various types of fires and select the proper extinguisher for their control.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Safety	<u>Related Knowledge</u> I. Things necessary for fire A. Fuel B. Oxygen C. Heat II. Classes of fire A. Class A - wood, paper, cloth B. Class B - flammable liquids C. Class C - electrical equipment D. Class D - combustible metals III. Fire extinguishers and symbols A. Type A extinguisher 1. Symbol - A in green triangle 2. For class A fires B. Type B 1. Symbol - B in red square 2. For class B fires C. Type C 1. Symbol - C in blue circle 2. For class C fires D. Type D 1. Symbol - D in yellow star 2. For class D fires IV. Fire safety rules A. Flammable liquids 1. Metal containers 2. Properly stored	Reading assignment Discuss Use chalkboard Passout: information sheet	Sup. Ref. C Instructor prepared

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Safety</u> (continued)	<u>Related Knowledge (cont'd)</u> B. Soldering C. Spontaneous combustion D. Ventilation E. Static electricity F. Fire extinguishers G. Housekeeping H. Fire hazard I. Smoking	Conduct fire safety inspection Safety test	
49	14	50	

MAJOR BLOCK I
ORIENTATION

TASK: 1. Shock Victim

AIM: The student will be able to describe traumatic shock and demonstrate methods of prevention and treatment.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
First Aid	<u>Related Knowledge</u> I. Causes of blood circulation loss to brain resulting in shock A. Severe loss of blood 1. Lacerations 2. Hemorrhage B. Loss of body fluids in dehydration 1. Diarrhea-vomiting 2. Burns 3. Excessive heat C. Restricted circulation 1. Constriction of blood vessels 2. Emotional trauma 3. Severe pain D. Heart failure E. Combination of above II. Stages of shock A. Primary shock 1. Victim shows signs of impending shock 2. Must be treated at once 3. Occurs with painful injuries a. Physical b. Psychological B. Secondary shock 1. Progresses from 1st stage 2. Time factor varies 3. Very often fatal III. General symptoms A. Skin pale, cold, moist	Lecture/discussion	Sup. Ref. I, International Association of Chiefs of Police, <u>Police Reference Notebook</u> , I.A.C.P., Eleven First Field Road, Gaithersburg, MD 20760, 1978.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
First Aid (continued)	<u>Related Knowledge (con't)</u> B. Fingernails, lips blue C. Rapid, weak pulse D. Breathing shallow E. Vomit common F. Lost bladder control G. Dazed appearance H. Eyes vacant IV. Treatment A. Precautions 1. Move victim no more than necessary 2. No excessive heat 3. Give no water a. Can cause vomiting b. Death from inhaling vomit B. Emotional shock 1. Remove the cause a. Assailant b. Rapist 2. Quiet, relaxed 3. Reassure victim 4. Have victim sit 5. Head between knees C. Physical injury shock 1. Stop bleeding 2. Restore breathing 3. Victim on back 4. Elevate feet a. Not if head injury b. Not if chest injury 5. Keep warm not hot 6. Refer to doctor 7. No water or alcohol D. Dehydration shock 1. Infants and children a. High fever b. Diarrhea c. Vomiting		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>First Aid</u> (continued)	<u>Related Knowledge (con't)</u> 2. Adults a. Burn victims b. Great fluid loss c. Death in minutes or hours <u>TASK DETAIL</u> Demonstrate treatment for shock Students to practice task		

ORIENTATION

AIM: The student will be able to demonstrate the ability to control loss of blood.

MINOR BLOCK	D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
First Aid		<u>Related Knowledge</u> I. Blood and vessels A. Components of blood 1. Plasma 2. Red cells 3. White cells 4. Platelets B. Functions 1. Food and oxygen 2. Body waste 3. Hormones/enzymes 4. Body temperature 5. Disease protection C. Vessels and circulation 1. Heart a. Parts b. Function 2. Vessels a. Arteries b. Capillaries c. Veins II. Blood loss A. Artery cut 1. Steady flow when deep 2. Spurts with heart beat 3. Bright red color B. Veins 1. Steady flow 2. Dark red color C. Capillaries 1. Slow seep 2. Brick red color D. Amount of loss in adult 1. One pint--not dangerous	Lecture/discussion Guest speaker	Sup. Ref. I

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>First Aid</u> (Continued)	<u>Related Knowledge (con't)</u> b. Large "T" on forehead 6. Removing tourniquet a. Death may result b. Only by physician <u>TASK DETAIL</u> Students should practice locating pressure points Stress safety precautions concerning pressure points in the neck region		

MAJOR BLOCK I

ORIENTATION

TASK: 3. Rescue Breathing

AIM: The student will be able to demonstrate the various methods used in artificial respiration.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
First Aid	<u>Related Knowledge</u> I. Facts about breathing A. Oxygen necessary to life - Without it brain is damaged - Death in six minutes B. Controlled by nervous system - Partial conscious control - Ribs and diaphragm II. Terms A. Asphyxia--breathing stoppage - Electric shock - Drowning - Injury B. Hypoxia--lack of oxygen - Smoke inhalation - Non-toxic gases C. Hypercapnea--cannot exhale - Wastes build up - Causes - Poisoning - Obstruction D. Cyanosis - Caused by above - Lips, fingernails blue - Exception - Carbon monoxide - Cherry red skin III. Rescue operations A. Check for breathing - Feel with fingertips - Ear close to mouth	Lecture/discussion	Sup. Ref. I

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>First Aid</u> (Continued)	<u>Related Knowledge (con't)</u> B. Check for obstructions 1. Visually 2. Listening a. Snoring caused by tongue b. Gurgling caused by liquid c. Crowing noise by object in throat C. Remove obstruction 1. Move tongue a. Tilt head back b. Jaw down and out 2. Foreign matter a. Roll adult on side b. Firm blows to back c. Small child over knee d. Slap between shoulders e. Check mouth for object D. Manual artificial respiration 1. Holger-Nielsen method a. Drownings b. Liquid blockage c. Procedure 2. Silvester method a. Smoke inhalation b. No obstruction c. Procedure E. Mouth to mouth/nose 1. Child a. Procedure b. Rate 2. Adult a. Procedure b. Rate		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>First Aid</u> (Continued)	<u>Related Knowledge (con't)</u> F. Mechanical resuscitation 1. Bellow-Mask type a. Advantages b. Disadvantages 2. Mechanical type a. Probably best b. Advantages c. Disadvantages <u>TASK DETAIL</u> Demonstrate proper procedures and have students practice		

MAJOR BLOCK I
ORIENTATION

TASK: 4. Bone Fractures

AIM: The student will be able to demonstrate proper procedures used in emergency care of victims with skeletal injuries.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
First Aid	<u>Related Knowledge</u> I. Human skeleton A. Purpose and function 1. Support and shape body 2. Muscle attachment 3. Protection of organs B. Types of bones 1. Long bones a. Arms and legs b. Leverage function 2. Short bones a. Vertebrae and ankles b. Movement and strength 3. Flat bones a. Skull, ribs, scapula b. Protection and support II. Bone fractures A. Causes 1. Sharp blows, pressure, etc. 2. Most common a. Falls b. Auto accidents B. Types 1. Hairline crack 2. Simple fracture 3. Compound fracture 4. Comminuted fracture	Lecture/discussion Secure human skeleton to demonstrate bone structure and function	Sup. Ref. I, Unit 5E High School biology dept.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>First Aid</u> (Continued)	<u>Related Knowledge (con't)</u> C. Fracture identification 1. Not always easy 2. X-ray 3. General symptoms a. Pain, tenderness b. Loss of movement c. Deformity d. Swelling e. Discoloration f. Grating g. Protruding fragment D. Specific fracture symptoms 1. Skull-brain damage a. Scalp wounds b. Unconscious c. Severe headache d. Abnormal eye pupils e. Bleeding eyes, nose, mouth f. Dazed, confused g. Paralysis h. Shock i. Face pale or flushed 2. Spinal fracture a. Extreme pain in back b. Shock c. Loss of feeling d. Paralysis of hands indicates neck e. Paralysis of toes, feet indicate back f. Lost bladder, bowel control		

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
First Aid (Continued)	<u>Related Knowledge (con't)</u> 3. Pelvis fracture a. Organ damage b. Cannot stand or sit c. Weakness d. Extreme pain sitting or standing e. No pain lying down f. Pain in groin, crotch g. Shock 4. Thigh fracture a. Severe pain b. Muscle spasms c. Deformity d. Severe shock 5. Rib fracture a. Painful breathing, coughing b. Sunken chest c. Coughing up blood 6. Collarbone a. Cannot raise arm b. Lowered shoulder c. Pain d. Holding elbow 7. Broken jaw a. Pain and swelling b. Trouble talking, chewing c. Teeth alignment off d. Bleeding gums III. Emergency treatment A. Stop severe bleeding	Stress cautions of proper handling	

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>First Aid</u> (Continued)	<u>Related Knowledge (con't)</u> B. Treat for shock C. Immobilize broken bones 1. Improvised splints 2. Improvised bandages 3. Application D. Get medical help <u>TASK DETAIL</u> Demonstrate procedures for emergency care of specific bones Students to practice splint application, moving, lifting, etc.		

MAJOR BLOCK I
ORIENTATION

TASK: 5. Moving Accident Victims

AIM: The student will be able to describe methods used to move injured persons, the dangers involved, and liability protection provided by Texas Laws.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
First Aid	<u>Related Knowledge</u> I. Legal aspects A. Good Samaritan Law 1. 57th Texas Legisla- ture 2. 1961 3. Person not liable 4. Exceptions to law 5. Reasoning behind law B. Hospital admissions 1. Authority of school administration 2. Emergency admissions 3. Temporary hospital- ization II. Moving accident victims A. Dangers involved 1. Death 2. Paralysis 3. Extended hospitaliza- tion B. Sometimes necessary 1. Burning buildings 2. Burning vehicle 3. Confined area 4. Others III. Methods of moving A. Pull to safety 1. Arm lock method 2. Blanket drag B. Carrying 1. Two-person carry 2. Chair carry a. Advantages of each b. When not used C. Substitute stretcher	Lecture/discussion	Sup. Ref. I, Unit 5E

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>First Aid</u> (Continued)	<u>Related Knowledge (con't)</u> 1. Blanket 2. Overcoat 3. Door 4. Plywood sheet D. Stretcher/litter methods 1. Take to victim 2. Lifting to stretcher a. Hammock carry b. Suspension lift c. Blanket lift <u>TASK DETAIL</u> Demonstrate methods Divide class into teams and have them practice methods		

MAJOR BLOCK I
ORIENTATION

TASK: 1. Identify the Place of VICA in the Structure of Vocational Education
AIM: The students will be able to identify VICA as an integral part of vocational education and to recognize the leadership opportunities inherent to the organization.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
VICA	<u>Related Knowledge</u> I. Background of the organization: Vocational Industrial Clubs of America II. Organization of VICA III. Opportunities for developing leadership abilities A. Serving as officer of local, area, or state chapter B. Attend leadership	Explain, briefly, the factors that led to the creation of VIC (later VICA) Explain the organization's place in vocational industrial education Present certain statistics on membership growth, increase in number of chapters, transition from state to national organization Show slides: Tell students what to look for in presentation Show slide presentation Discuss presentation Explain organization aspects: local chapter, district, state and national affiliations Outline administrative structure: local advisor, superintendent, area supervisor, state executive secretary, and national executive secretary Transparency on organizational structure of VICA organization Leadership skills learned while: Serving as chairperson of committee, or committees Guest speaker	Sup. Ref. E, VICA Handbook Vocational Industrial Clubs of America, Inc., 105 N. Virginia Ave., Falls Church VA 22046 Slides: VICA, <u>Developing Leaders for Tomorrow's Industry</u>, Vocational Instructional Services, F.E. Box 182, Texas A&M University, College Station, TX 77843 Sup. Ref. J Instructor prepared Sup. Ref. J Guest speaker: Former VICA student: district officer; or second

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>VICA</u> (continued)	<u>Related Knowledge (cont'd)</u> training conferences at area, state, or national level IV. Participate in local chapter activities A. Competitive activities B. Social activities C. Service activities D. Open house for public school week E. Parents night F. Initiation banquet G. Assembly program V. Participate in area meeting and state convention A. Chapter events B. Speed-skill contest C. Technical information D. Student selected jobs E. Individual events	Explain and discuss chapter activities with students Plan year's activities Show slides of previous year's activities Explain and discuss areas of competition at area and state level Discuss students' preparation for the events Refer to previous winners	year VICA student from another club or town or club Slides or photo of previous club activities Suggested plan for year's activities Sup. Ref. K, Texas <u>National VICA Com- petitive Activities Guide</u> , VIS, F.E. Box 182, Texas A&M Uni- versity, College Station, TX 77843 - 1979 Sup. Ref. L, VICA <u>U.S. Skill Olympics Regulations</u> , <u>Vocational Industrial Clubs of America Inc.</u> , 105 N. Virginia Ave., V.A. 22046

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>VICA</u> (continued)	<u>Task Detail</u> 1. Nomination of officer candidates 2. Election of officers 3. Installation of officers 4. Students design VICA posters 5. Collection of dues 6. Initiation day and ceremony 7. Plan program	Review qualifications of officers elect Review duties and responsibilities Review election procedures Review and rehearse installation procedure Assignment on installation ceremony Review school policy on hanging posters and types of posters Review proceedings for initiation ceremony	Nomination forms Election ballots

MAJOR BLOCK I

ORIENTATION

TASK: 2. Local Club Organization

AIM: The student will know the structure, functions and goals of the local VICA organization and will be given the opportunity to participate as an officer, chairperson or assisting member.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
VICA	<u>Related Knowledge</u> I. Membership drive - Student awareness - Collection of dues - Organization report - Initiation ceremony II. Election of officers - Duties of officers - Qualifications - Nomination of candidates - Voting - Installation of Officers III. Planning program - Meetings - Business - Social meetings - Dates - Social activities - Family banquet - Dances - Service activities - Competitive activities - Local - Area - State - Public relations	Display of VICA posters and signs Explain duties and responsibilities of officers Explain procedure for nomination of officers Explain and review installation of officers Discuss plans for year Set up meetings Set up committees	Student - teacher prepared VICA signs Sup. Ref. M, <u>VICA Initiation Ritual</u>, VIS, F.E. Box 182, Texas A&M University, College Station, TX 77843 Sup. Ref. J Instructor prepared; nomination forms, voting ballots, information sheet on qualifications Sup. Ref. N, <u>Official Officer Installation</u>, VIS, F.E. Box 182, Texas A&M University, College Station, TX 77843 Instructor - student prepared listing of possible club activities

MAJOR BLOCK I

ORIENTATION

TASK: 3. Parliamentary Procedure

AIM: The student will obtain a basic knowledge of parliamentary practices through a comprehensive study of the basic rules of parliamentary procedure and by applying that knowledge through participation in an active club.

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
VICA	<u>Related Knowledge</u> I. Importance of parliamentary procedure A. Local club B. Civic organization C. Business firms II. Application of parliamentary procedure A. Conduct business B. Competition <u>Task Detail</u> Gain knowledge and skill through a study of the basic rules; practice the application of the rules in an active situation; and participate in competition on area, state, and national level	Assigned reading Assignment as pertains to rule (chapter's) Discuss importance of having organized controlled meetings Show filmstrip Tell students what to look for in filmstrip Discuss filmstrip Test over filmstrip Guest speaker Assign each chapter to be covered Explain and discuss chapter Ask questions Assign practice problems Test Application at club meetings and contest	Sup. Ref. O, <u>Parliamentary Guide for Vocational Industrial Clubs of America</u>, Gray, Jerrell D., VIS, F.E. Box 182, College Station, TX 77843 Sup. Ref. P, <u>Parliamentary Procedure Workbook</u>, VIS, F.E. Box 182, College Station, TX 77843 Filmstrip: <u>Parliamentary Procedure in Action</u>, Parts I, II, III, Educational Film Strips, Box 289, Huntsville, TX 77340 Guest speaker: Professional parliamentarian who is obtained by city government to preside at meetings

BASIC SKILLS

AIM: The student will be able to manipulate and solve algebraic equations necessary for finding unknown quantities in electricity.

MINOR BLOCK	A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Mathematics		<u>Related Knowledge</u> I. Arithmetic review A. Addition 1. Whole numbers 2. Fractions 3. Mixed numbers 4. Decimals B. Subtraction 1. Whole numbers 2. Fractions 3. Mixed numbers 4. Decimals C. Division 1. Whole numbers 2. Fractions 3. Mixed numbers 4. Decimals D. Multiplication 1. Whole numbers 2. Fractions 3. Mixed numbers 4. Decimals II. Algebra review A. Literal numbers 1. Subscript 2. Prime notation a. Double prime b. Triple prime B. Algebraic expression 1. Terms 2. Algebraic sum 3. Coefficients 4. Fractions a. Numerator b. Denominator C. Equations 1. Identical equations	Discussion State rules for each Use chalkboard Work problems Student work problems Review Quiz Definitions Chalkboard illustrations	Supplemental Reference #1 Barker, Furrest I., <u>Problems in Technical Mathematics for Electricity and Electronics</u> , Cummings Publishing Company, Reading, Massachusetts, 01867

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Mathematics</u> (Continued)	<u>Related Knowledge (Con't)</u> 2. Conditional equations III. Manipulations A. Equality must be maintained B. Unknown factor C. Unknown divisor D. Unknown term E. Combined manipulations F. Checking solutions IV. Writing equations A. Makes a statement B. Alegbraic language 1. Word by word 2. Idioms C. Proportional relationships 1. Inversely proportional 2. Directly proportional V. Formulas A. Ohm's Law B. Kirchhoff's Law <u>TASK DETAIL</u> Teacher prepared assignment sheet	Work problems Demonstrate Work problems Quiz	

MAJOR BLOCK II

BASIC SKILLS

TASK: 2. Application of Mathematics

AIM: The student will be able to make practical application of mathematics by solving problems with materials, Ohm's Law, Power, and other formulas common the the electrical trades.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Measurement	<u>Related Knowledge</u> I. Materials A. Measure B. Layout C. Write specifications II. Ohm's Law A. Application B. Formula 1. Voltage 2. Amperage 3. Resistance C. Series circuits D. Parallel circuits III. Power A. Formula B. Application IV. Circuits		

MAJOR BLOCK II

BASIC SKILLS

TASK: 1. Identify Electrical Symbols, Abbreviations, and Notations

AIM: The student will be able to identify and interpret architectural and electrical symbols, notations, abbreviations, and interpret residential and industrial prints as they apply to the electrician.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Print Reading	<u>Related Knowledge</u> I. Architectural drawings A. Graphic representation 1. Lines 2. Symbols 3. Notations 4. Dimensions B. Purpose II. Line representation A. Visible lines B. Dimension lines C. Extension lines D. Hidden lines E. Leaders F. Center lines G. Break lines H. Cutting-plane lines III. Dimensions and notations A. Purpose B. Types C. Application IV. Symbols A. Material B. Electrical D. Structural E. Plumbing F. Mechanical V. Architectural plans A. Floor plan B. Plot plan C. Elevation plan D. Foundation plan E. Electrical plan F. Plumbing and gas plan G. Air conditioning plan H. Roof plan I. Specifications	Assigned reading Pass out: Information Sheet Discuss lesson Explain: 1. Graphic representations 2. Line representations 3. Definitions 4. Symbols 5. Notations Show transparencies Show sample of plans Explain information contained Test	Ref. #4, Alerich, Walter N., <u>Electrical Construction Wiring</u>, American Technical Society, Chicago, IL 60637 ISBN: 0-8269-1420-9 Information Sheet: Teacher prepared Sup. Ref. Q, Wyatt, William E. <u>General Architectural Drawing</u>, Charles A Bennett Co., Inc., Peoria, IL 61614 Transparency: Teacher prepared Sample set of architectural plans

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Print Reading</u> (continued)	<u>Task Detail</u> Have students: 1. Identify and define symbols, line representations, and notes 2. Explain information given in each plan 3. Identify the electrical circuits and fixtures in the plan 4. Identify the information given in the specifications	Demonstrate procedure Assign tasks Supervise work Check student's progress	Assignment sheets: Teacher prepared

MAJOR BLOCK II

BASIC SKILLS

TASK: 2. Trace Route of Electrical Circuit

AIM: The student will be able to read and interpret architectural plans for the purpose of tracing circuits, determining the number and type of circuits, planning the circuits, and identifying structural members of the house.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Print Reading	<u>Related Knowledge</u> I. Refer to Major Block II, Minor Block B, Task 1 for related information II. National Electric Code A. Purpose B. Use of III. Electrical circuits A. Definition B. Service entrance panel C. Feeder circuit D. Branch circuit 1. Small appliance 2. General purpose 3. Individual equipment IV. House structure A. Structural parts B. Materials <u>Task Detail</u> Have students: 1. Lay out circuits on floor plan to conform with local or national electric code 2. Locate and identify different types of circuits and electrical outlets	Assigned reading Review: 1. Electrical symbols 2. Notations 3. Abbreviations 4. Reading the electrical plan 5. Specifications Pass out: Information Sheet Discuss lesson Ask questions Illustrate: 1. Electrical plan 2. Electrical circuit 3. Structural parts of house Test Show transparency Demonstrate procedure Assign tasks Supervise work Check student's progress	Ref. #1 Information Sheet: Teacher prepared Ref. #2, National Fire Protection Association, <u>National Electric Code</u>, <u>National Fire Protection Association</u>, Batterymarch Park, Quincy, MA 02269 Transparency: Teacher prepared Assignment Sheets: Teacher

MAJOR BLOCK II

BASIC SKILLS

TASK: 1. Tool and Equipment Check-Out Procedure

AIM: The student will be able to identify and perform responsibly and safely in the use, care of, and storage of tools and equipment.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Tools and Lab Procedure	<u>Related Knowledge</u> I. Class organization A. Importance B. Personal opportunities C. Duties and responsibilities D. Rotation assignments E. Official duties and reports II. Laboratory activities A. Storage procedure B. Check-out system C. Responsibility for equipment D. Maintenance and care E. Return of tools and equipment III. Shop activities A. Operation hazards B. Work experience 1. Equipment storage 2. Parts requisitioning 3. Job procedures 4. Use of basic equipment IV. Housekeeping A. Responsibilities B. Specific assignments	Pass out: Information Sheet Discussion Oral questions Tour storage area Discuss procedure Demonstrate: 1. Check-out procedure 2. Maintenance of tools and equipment 3. Check-in procedure	Information Sheet: teacher prepared Sup. Ref. D

BASIC SKILLS

AIM: The student will be able to identify, select, and properly use those tools that are common to the trade and demonstrate a safe work attitude.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Tools and Lab Procedure	<u>Related Knowledge</u> I. Hand tools A. Types 1. Chisels 2. Level 3. Hammers 4. Hacksaws 5. Nut driver 6. Pliers 7. Punches 8. Rivet gun 9. Rulers 10. Screwdrivers 11. Cable cutter 12. Wire gauges 13. Wire strippers 14. Plumb bob 15. Retractable tape measure 16. Saw 17. Hole saw bit 18. Conduit bender 19. Fish tape 20. Electrician tool pouch B. Selection and use 1. Job required 2. Procedure in use 3. Safety C. Maintenance 1. Storage 2. Servicing 3. Reconditioning II. Power tools A. Drills 1. Types a. Bench	Reading assignment Pass out: Information Sheet Discuss lesson Display tools and identify Use audio-visuals: 1. Transparencies 2. Films 3. Charts Oral questions Demonstrate and discuss: 1. Selection 2. Use 3. Maintenance and reconditioning 4. Storage 5. Safety Pass out: Information Sheet Demonstrate and discuss: 1. Types of power tools 2. Maintenance	Information Sheet: teacher prepared Sample tools Teacher prepared, available films, and manufacturer's charts Information Sheet: teacher prepared Samples

MAJOR BLOCK III
POWER SOURCES

TASK: 1. Structure of Matter

AIM: The student will be able to describe movement of electrons; discuss the law of electrical charges; and demonstrate the ability to create and observe the behavior of electrical charges.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Batteries	<u>Related Knowledge</u> I. Nature of matter - Atoms - Compounds - Molecules - Elements II. Structure of Atoms - Electrons - Neutrons - Protons - Nucleus - Electron shells III. Location of atomic particles - Nucleus - Protons - Neutrons - Orbiting nucleus - Electrons - Inner orbit - Outer orbit IV. Law of electrical charges - Ion - Positive - Negative - Repulsion and attraction - Like charges repel - Unlike charges attract <u>Task Detail</u> Produce and observe the behavior of electrostatics - Suspend two pith balls or balloons connected by a thread or string - Positively charge a glass rod by rubbing with silk or wool	Reading assignment Pass out: - Information Sheet - Assignment Sheet Discuss: - Objectives of unit - Definitions - Relationship of parts of the atom Show transparency: The structure of an atom Illustrate on chalkboard Test Demonstrate experiment Assign task Supervise practice Check students' progress	Ref. #3, Mileaf, Harry, <u>Electricity One-Seven</u>, Hayden Book Co., Inc., Rochelle, N.J. Information Sheet: teacher prepared Assignment Sheet: teacher prepared Transparency: teacher prepared Chalkboard Test: teacher prepared Job Sheet: teacher prepared Materials required: 2 - pith balls or balloons String Silk or wool cloth Glass rod Stand

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Batteries</u> (continued)	<u>Task Detail (con't)</u> 3. Bring rod near pith balls 4. Observe the attraction the balls have for the rod 5. Observe the balls for repulsion as they touch the rod 6. Explain why the rod attracted and then repelled the balls		

MAJOR BLOCK III

POWER SOURCES

TASK: 2. Test Voltage of Dry Cell Battery

AIM: The student will be able to explain the construction, action, care and use of dry cell batteries; check voltage in series and parallel circuits.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Batteries	<u>Related Knowledge</u> I. Electron theory A. Electron energy B. Producing electricity C. Conductors D. Insulators E. Semiconductors II. Chemical electricity III. Dry cell batteries A. Construction B. Action C. Use D. Care IV. Types dry cell batteries A. LaClanche cell B. Mercury cell C. Nickel-cadmium rechargeable cell V. Ohm's Law A. Voltage B. Resistance C. Current VI. Series circuits A. Definition B. Series power source C. Power consumption D. Voltage drop <u>Task Detail</u> 1. Examine dry cell batteries a. Styles b. Sizes c. Construction 2. Connect several cells and check voltage a. Series b. Parallel	Assigned reading Discuss lesson Ask questions Pass out: Information Sheet Illustrate: 1. Dry cell construction 2. Types of dry cell batteries Demonstrate: 1. Application of Ohm's law 2. Series circuits 3. Parallel circuits 4. Math problems related to Ohm's Law Define terms Test	Ref. #3 Information Sheet: teacher prepared Chalkboard Samples of batteries Test: teacher prepared Assignment sheet: teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Batteries (continued)	<u>Task Detail (con't)</u> 3. Check voltage with battery connected to load bank 4. Connect two dry cells in circuit with a lamp and switch 5. Examine mercury cell 6. Check voltage of mercury cell a. Single cell b. Multicells in series c. Multicells in parallel 7. Measure current flow of circuit containing two mercury cells in series with one Ohm of resistance		

MAJOR BLOCK III

POWER SOURCES

TASK: 3. Inspect, Add Electrolyte, and Test Lead Acid Battery

AIM: The student will be able to explain the construction and operation of the lead acid wet cell battery; add electrolyte; make specific gravity and cell test; and demonstrate the use of lead acid batteries as power sources.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Batteries	<u>Related Knowledge</u> I. Review Major Block III, Minor Block B, Task 2, "Test Voltage of Dry Cell Battery" II. Wet cell batteries A. Construction 1. Electrodes (plates) a. Materials b. Size c. Number d. Function 2. Electrolyte a. Chemical b. Electrolytic action c. Mix electrolyte d. Specific gravity 1) Charged 2) Discharged e. Safety B. Types C. Test battery 1. Hydrometer 2. Cell tester D. Charge battery 1. Procedure 2. Safety III. Hydrometer A. Use B. Care IV. Cell tester A. Use B. Care V. Ammeter A. Use B. Care VI. Ohmmeter A. Use B. Care	Assigned reading Review: 1. Electron theory 2. Chemical electricity Pass out: Information Sheet Illustrate 1. Battery construction 2. Electrolyte 3. Types of wet cell batteries 4. Hydrometer 5. Cell tester Define terms Ask questions Demonstrate: 1. Mixing electrolyte 2. Testing electrolyte 3. Testing cells 4. Use of hydrometer 5. Use of cell tester 6. Use of Ohmmeter 7. Use of Ammeter Test	Ref. #3 Information Sheet: teacher prepared Sample Charts Materials and equipment available Test: teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Batteries</u> (continued)	<u>Task Detail</u> 1. Examine lead acid battery and identify parts 2. Add electrolyte to battery and take specific gravity test with hydrometer 3. Test open circuit voltage 4. Connect two lead acid batteries in series and test voltage 5. Connect two lead acid batteries in parallel and test voltage 6. Test for dead cell using battery tester 7. Connect lead acid battery in circuit containing buzzer and push button switch	Demonstrate task Review safety procedures Assign task Supervise assignment Check students' performance	Assignment Sheet: teacher prepared

MAJOR BLOCK III

POWER SOURCES

TASK: 1. Construct, Inspect, and Test a Thermocouple

AIM: The student will be able to explain the construction and use of a thermocouple, identify the parts, and test its use as a heat sensing device, and safety device.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Special Power Sources	<u>Related Knowledge</u> I. Principles of thermocouple A. Electromagnetic effect B. Thermal effect C. Operation D. Use II. Construction A. Dissimilar metals B. Moving coil meter III. Heat/voltage relationship IV. Thermopile A. Operation B. Uses V. Testing thermocouples <u>Task Detail</u> 1. Examine thermocouple construction 2. Apply heat to junction point and observe induced voltage as heat intensity is varied 3. Connect thermocouple into heater circuit and observe it as a heat sensing device 4. Connect into a pilot light circuit and observe it as a safety device 5. Connect several together, heat junctions and check voltage	Assigned reading Discuss lesson Ask questions Pass out: Information Sheet Illustrate: 1. Thermocouple construction 2. Sample of a thermocouple Define terms Test Demonstrate task Review safety precautions Assign task Supervise assignment Check students' performance	Ref. #3 Information Sheet: teacher prepared Chalkboard Manufacturer's chart Sample thermocouple Test: teacher prepared Assignment Sheet: teacher prepared

MAJOR BLOCK III

POWER SOURCES

TASK: 2. Construct, Inspect, and Test Use of Photoelectric Cell

AIM: The student will be able to explain the principles of photoelectricity, construction and use, identify types, and test its use as a switch.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Special Power Sources	<u>Related Knowledge</u> I. Principles of photoelectricity II. Construction A. Light beam B. Energy releasing materials - Potassium - Sodium - Cesium - Lithium - Selenium - Cadmium - Germanium III. Types of photoelectric cells A. Photoemission B. Photovoltaic C. Photoconduction IV. Photoelectric cells A. Output B. Capacity C. Action - Series - Parallel D. Uses <u>Task Detail</u> - Examine photoelectric cell - Construction - Light sensitive surface - Apply light to surface and check voltage - Connect several cells in series and check voltage output - Utilize photoelectric cell with light as a switch	Reading assignment Discuss lesson Ask questions Pass out: Information Sheet Illustrate: - Photoelectric construction - Sample of photoelectric cell Define terms Test Demonstrate task Review safety procedure Assign task Supervise assignment Check students' performance	Ref. #3 Information Sheet: teacher prepared Chalkboard Sample photoelectric devices Test: teacher prepared

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Special Power Sources</u> (continued)	<u>Task Detail (con't)</u> 5. Connect photoelectric cell in circuit to detect the presence of light and sound an alarm		

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MAJOR BLOCK III

POWER SOURCES

TASK: 1. Disassemble, Inspect, and Test D.C. Generator

AIM: The student will disassemble, inspect and identify parts, reassemble, and test for proper operation.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
D.C. Generators	<u>Related Knowledge</u> I. Electromagnetism II. D.C. Generators A. Principle parts 1. Magnetic field 2. Single conductor 3. Commutator 4. Brushes B. Types 1. Shunt wound 2. Series wound 3. Compound wound III. Voltage regulator A. Operation B. Function IV. Current regulator A. Operation B. Function V. Reverse-current cutout relay A. Operation B. Function VI. Combined regulation VII. Trouble shooting A. Test equipment B. Procedure <u>Task Detail</u> 1. Disassemble and identify parts 2. Clean parts 3. Inspect for damage or excessive wear 4. Reassemble parts 5. Test a. Operation b. Voltage output 6. Seat brushes	Assigned reading Lecture: Explanation of types and parts of generator Illustrate the function of parts Transparencies Discuss: 1. Operation of the various regulators 2. Function Review lessons Ask questions Test Demonstrate task Review safety procedure Assign task Supervise assignment Check students' performance	Ref. #3 Ref. # , Lytell, Allan, <u>ABC's of Electric Motors and Generators</u>, Howard W. Sams, and Co., 4300 West 62nd St., Indianapolis, IN 46268 Transparencies: VIS #48-52 Test: teacher prepared Assignment Sheet: teacher prepared

MAJOR BLOCK III

POWER SOURCES

TASK: 1. Disassemble, Inspect, and Test Alternators

AIM: The student will be able to explain the types and operation, disassemble, inspect and identify parts, reassemble, and test for proper operation.

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Alternator	<u>Related Knowledge</u> I. Alternation-generator comparison II. Alternating current III. Induced voltage IV. Principles of excitation V. Alternators A. Principal parts B. Types 1. Slip rings 2. Solid state 3. Single phase 4. Three phase VI. Connection of output leads A. Single phase B. Three phase VII. Troubleshooting A. Insulation resistance tester B. Industrial analyzer C. Procedure D. Computing 1. RPM 2. Frequency 3. Poles <u>Task Detail</u> 1. Disassemble and identify parts 2. Clean parts 3. Inspect parts for damage and excessive wear 4. Reassemble parts 5. Test: a. Operation b. Voltage output 6. Seat brushes	Assigned reading Discuss lesson Pass out: Information Sheet Illustrate: 1. Alternator construction 2. Troubleshooting equipment Show transparencies Ask questions Explain and demonstrate troubleshooting procedures Test Demonstrate task Review safety precautions Assign task Supervise assignment Check students' performance	Ref. #3 Information Sheet: teacher prepared Transparencies: VIS, #53-64 Test: teacher prepared Assignment Sheet: teacher prepared

MAJOR BLOCK IV
RESIDENTIAL WIRING

TASK: 1. Identify and Calculate Required Circuits

AIM: The student will be able to identify the different circuits, calculate the required number of circuits and outlets per circuit as required by local and national code, and layout circuit routes on floor plan.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Rough-in Wiring	<u>Related Knowledge</u> I. Refer to Major Block II, Minor Block B, Task 2, "Trace Route of Electrical Circuit", for related information II. Insulator A. Definition B. Type C. Relationship with wire size D. Use III. Conductor A. Definition B. Conductor material 1. Copper 2. Aluminum 3. Copper-clad aluminum IV. Circuits A. Types B. Number C. Limitations 1. Outlets per circuit 2. Separate circuits D. Feeder circuit V. Ampacity A. Electric load B. Wire size C. Panel size <u>Task Detail</u> Have students: 1. Determine number and size circuits a. General purpose	Assigned reading Passout: Information Sheet Passout: Information Sheet Review: 1. Reading electrical plan 2. Circuit identification 3. Ohm's Law as applied to determination of load 4. National and local code on conductors Demonstrate: 1. Calculation of circuits 2. Grouping of outlets 3. Determination of wire size and outlets 4. Assignment of outlets to circuit 5. Layout of circuits on plan Define and explain terms Show Transparencies Demonstrate procedure Assign tasks	Ref. #4, Electrical Wiring, American Association for Vocational Instructional Materials, 120 Engineering Center, Athens, GA 30602 Information Sheet: Teacher prepared Ref. #2 Transparencies: Teacher prepared Assignment sheet: Teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rough-in Wiring</u> (Continued)	<u>Task Detail (con't)</u> b. Small appliance c. Individual equipment 2. Determine number of outlets per circuit and size 3. Layout circuit route on floor plan a. Circuit number b. Wire size 4. Develop electrical schedule or table a. Circuit location b. Circuit number c. Lighting outlets d. Convenience outlets e. Special equipment outlets f. Total outlets	Supervise work Check students performance	

MAJOR BLOCK IV
RESIDENTIAL WIRING

TASK: 2. Locate and Mark Circuit Routes

AIM: The student will be able to locate, mark the cable run, and identify the circuit for small appliance, general purpose, and individual circuits according to given floor plan.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Rough-in Wiring	<u>Related Knowledge</u> I. Refer to Major Block IV, Minor Block B, Task 1, "Identify and Calculate Required Circuits" II. Structural parts of the house A. Name B. Size C. Location III. Service Entrance panel A. Location 1. Service entrance 2. Large conductors B. Code requirements C. Marking location IV. Small appliance circuit A. Locate receptacle outlet 1. Floor plan 2. Stud a. Wall b. Kitchen counter B. Circuit run C. Circuit identification 1. Floor plan 2. Walls or studs V. General purpose circuit A. Location of receptacles 1. Height 2. Position	Review: 1. Circuits identification 2. Ampacity 3. National Electrical Code 4. Local Code Assigned reading Pass Out: Information Sheet Explain: 1. House structure 2. Importance of knowing the house parts Show transparency Demonstrate: 1. Locating outlets 2. Marking circuits 3. Identifying circuits Explain: Terms and definitions Ask questions Test	Information Sheet: Teacher prepared Transparency: Teacher prepared Floor plan, model of house, or residential building

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rough-in Wiring</u> (continued)	<u>Related Knowledge (con't)</u> B. Location of wall switches C. Overhead light outlets D. Circuit run E. Circuit identification VI. Individual circuits A. Circuit size B. Cable or circuit run C. Circuit identification D. Location VII. Outside circuits A. Location B. Ground fault circuit interrupters <u>Task Detail</u> Have students: 1. Locate, mark and identify small appliance circuit outlets 2. Locate, trace cable run, mark, and identify general purpose circuits a. Lighting outlets b. Wall receptacles c. Switches 3. Locate, trace cable run, mark and identify individual circuits 4. Locate, trace cable run, mark and identify outside receptacles	Demonstrate procedure Assign tasks Supervise work Check students' performance	Assignment Sheets: Teacher prepared

MAJOR BLOCK IV
RESIDENTIAL WIRING

TASK: 3. Install Device and Outlet Boxes

AIM: The student will be able to identify and select different types and styles of device and outlet boxes, determine use in accordance with National and local codes, and properly install boxes.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Rough-in Wiring	<u>Related Knowledge</u> I. Device boxes A. Definition B. Use 1. Switch box 2. Receptacle 3. Other C. Type 1. Material a. Galvanized b. Plastic 2. Shape a. Square corner b. Beveled corner 3. Size a. Trade size b. Capacity c. Surface/handy box 4. Gang boxes/devices D. Parts 1. Box 2. Cover a. Switch b. Receptacle 3. Pryouts 4. Knockouts 5. Knockout seal 6. Mounting ears 7. Pigtail grounding wire 8. Grounding clip 9. Grounding clamp 10. Cable connectors II. Outlet boxes A. Definition B. Use 1. Overhead lighting 2. Others	Reading assignment Pass Out: Information Sheet Review: Types, use, and selection of device and outlet boxes Review: National and Local code on use of boxes Illustrate: 1. Device and outlet boxes 2. Accessory parts 3. Proper installation procedure Ask questions	Ref. #4 Information Sheet: Teacher prepared Ref. #2 Sample of device and outlet boxes

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rough-in Wiring</u> (continued)	<u>Related Knowledge (con't)</u> C. Types 1. Octagonal 2. Square 3. Ring D. Size 1. Trade size 2. Capacity E. Outlet box covers 1. Flat blank 2. Round blank 3. Raised device 4. Flat device F. Extension ring III. Conductor allowance A. Device boxes B. Outlet boxes C. Box devices 1. Strap 2. Stud 3. Cable clamp 4. Hickey IV. Selection A. Conductor capacity B. Allowance for box devices V. Procedure for installing boxes A. On studs B. Between studs C. Old buildings D. In handy boxes E. Using bar hangers <u>Task Detail</u> 1. Mount boxes for receptacles and switches a. Remove knockouts b. Determine mounting depth c. Nail to stud	Demonstrate procedure Assign tasks	Assignment Sheet: Teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rough-in Wiring</u> (continued)	<u>Task Detail (con't)</u> 1) top and bottom mount 2) side mount d. Old buildings 1) layout box opening 2) cut out hole 3) mount box e. Boxes between studs 1) locate and mount bar hangers 2) locate and mount box 2. Install handy boxes a. Location b. Fastening to frame wall c. Fastening to concrete blocks 3. Install outlet boxes a. Select box b. Determine mounting depth c. Install with mounting brackets d. Install with bar hangers	Supervise work Check students' performance	

MAJOR BLOCK IV
RESIDENTIAL WIRING

TASK: 4. Provide Access for Non-metallic Sheath Cable

AIM: The student will be able to determine proper access route for non-metallic sheath cable, identify methods for providing cable access, and provide access for drilling, notching or installing guard strips and running boards.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Rough-in Wiring	<u>Related Knowledge</u> I. Cable access A. Path of cable B. SEP to outlets C. Protect cable II. Access method A. Drilling holes 1. Hole size 2. Location a. From edge b. Elevation change c. Plate d. Stud e. Joist 3. Cable protection B. Notching framework 1. Code specifications 2. Location a. Bottom of stud b. Edge of stud 3. Protection plate 4. Size a. 2" x 4" b. 2" x 6" C. Guard strips 1. Purpose 2. Code requirement a. Easy access to attic b. Attic not accessible c. Spacing d. Fastening e. Material 3. Installation	Assigned reading Pass Out: Information Sheet Discuss: Code requirement for providing cable access Review: Proper selection, safety, and use of tools Demonstrate: Methods of providing access of cable Ask questions Test	Ref. #2 Information Sheet: Teacher prepared Ref. #4

MAJOR BLOCK IV
RESIDENTIAL WIRING

TASK: 5. Pull Non-metallic Sheathed Cable Between Outlets and Anchor

AIM: The student will be able to identify and select proper cable, give the characteristics of the cable, pull cable through the circuit, identify, select, and fasten cable with connectors to box, and anchor cable to frame structure.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Rough-in Wiring	<u>Related Knowledge</u> I. Non-metallic sheath cable II. Type of wire A. Copper B. Aluminum C. Copper-clad aluminum III. Characteristics of wire A. Type of conductor B. Type insulation C. Type application D. Operating temperature E. Type outer sheath F. Number of conductors G. Conductor size H. Cable use I. Color coding 1. Two-wire 2. Three-wire without ground 3. Two-wire with ground a. Insulated/ground b. Bare ground IV. Residential cable A. Type 1. Type NM 2. Type NMC B. Size 1. Copper 14-2 2. Aluminum 12-2 3. Copper-clad aluminum 12-2 C. Use 1. Type NM 2. Type NMC D. Cable identification 1. Letters - type wire	Assigned reading Pass Out: Information Sheet Discuss: Selection, types, characteristics, advantages, disadvantages and use of non-metallic sheath cable Illustrate: Samples of cables Show sample of cable with identification	Ref. #2, Code Table 310-3 Ref. #4 Information Sheet: Teacher prepared Sample cables Sample

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rough-in Wiring</u> (continued)	<u>Related Knowledge (con't)</u> 2. Maximum working voltage 3. Manufacturer's name 4. AWG or Mil Size E. Ampacity V. Cable pulling A. Box container B. Reel C. Length of cable D. Splice allowance 1. Inside box 2. SEP cabinet E. Allowable bends VI. Procedure A. Pulling cable B. Fastening cable in boxes 1. Connectors a. Connector/locknut b. Plastic snap-in 2. Clamps a. Snap-in type wedge b. Quick clamp C. Anchoring cable 1. Types of anchors a. Staples b. Cable straps 2. Placement of anchors 3. Precautions <u>Task Detail</u> Have students: 1. Select proper cable for circuit 2. Remove cable from box or reel and cut to length 3. Pull cable through holes, notches, guard strips, or over running boards	Explain information Demonstrate: Removal of cable from box and reel Review the procedure for pulling cable, connecting in boxes, and anchoring cable Ask questions Test Demonstrate procedure Assign tasks Supervise work	Box of cable Test: Teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rough-in Wiring</u> (continued)	<u>Task Detail (con't)</u> 4. Pull cable through each opening to the outlet or switch box 5. Pull through knockout holes NOTE: Allow for splices and connections 6. Cut cable to length 7. Remove sheathing 8. Fasten cable in boxes 9. Pull cable for remaining boxes 10. Pull cable to switch box 11. Identify the branch circuit at SEP 12. Anchor cable	Check students' performance	
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MAJOR BLOCK IV
RESIDENTIAL WIRING

TASK: 6. Install Low Voltage Wiring

AIM: The student will be able to define terms and definitions; describe the circuits created in low voltage wire; identify the parts of the low voltage wiring system and install low voltage wire.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Rough-in Wiring	<u>Related Knowledge</u> I. Electromagnetism II. Basic alternating current III. Low voltage wiring system A. Transformer B. Relay C. Contact switch D. Low voltage cable E. Wiring F. Boxes G. Gang plaster rings IV. Types of low voltage circuits A. Lighting B. Chime or bell C. Thermostat 1. Manual fan control 2. Automatic fan control D. Anticipator V. Advantages and disadvantages of low voltage wiring VI. National Electrical Code VII. Safety <u>Task Detail</u> Have students perform the following tasks as materials and resources permit: 1. Install wiring for doorbells/chimes/buzzer 2. Install wiring for smoke detector 3. Install wiring for wall thermostat	Assigned reading Passout: Information sheet Explain the system Review terms and definitions Show Transparencies 1. Low voltage system 2. Low voltage circuits Discuss NEC article TLS Test Demonstrate procedure Assign tasks Supervise work Check student's performance	Information sheet: Teacher prepared Ref. #5, <u>Touch-Plate Low Voltage Light Control</u>, Touch-Plate Electro Systems, Paramount, CA. Transparencies: Teacher prepared Ref. #6, Graham, Kennard C., <u>Interior Electrical Wiring</u>, American Technical Society, 848 E. 58th St., Chicago, IL 60637 Ref. #2 Test: Teacher prepared Assignment sheet: Teacher prepared Materials and tools

MAJOR BLOCK IV
RESIDENTIAL WIRING

TASK: 7. Install Wiring for Radio and Intercom System

AIM: The student will be able to explain the radio and intercom system; identify materials; and tools required to properly install system; and properly install boxes and wiring.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Rough-in Wiring	<u>Related Knowledge</u> I. Radio and intercom operation II. Conductors A. Type B. Size C. Installation 1. Raceways and boxes 2. Open/conductors III. Protective devices IV. Safety <u>Task Detail</u> Have students: 1. Identify wiring boxes, switches, protective devices required. 2. Install boxes and wiring as resources permit.	Assigned reading Passout: Information Sheet Discuss: 1. Radio and intercom system 2. Terms and definitions Review: National Electric Code Ask questions Test Demonstrate procedure Assign tasks Supervise work Check student's performance	Information sheet: Teacher prepared Ref. #2 Test: Teacher prepared

MAJOR BLOCK IV
RESIDENTIAL WIRING

TASK: 8. Install Wiring for Television and Telephone

AIM: The student will be able to explain the television and telephone operational system; identify the materials and tools required to properly install system; and properly install boxes and wiring.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Rough-in Wiring	<u>Related Knowledge</u> I. Television systems A. Master antenna television system (MATV) B. Individual antenna - receiver system C. VHF D. UHF E. Amplifier F. Splitter G. Couplers II. Telephone system III. Coaxial cable A. Construction B. Types C. Sizes D. Installation IV. Protective devices A. Location B. Protector requirements V. Communication conductors A. Outlet boxes B. Junction boxes VI. Safety <u>Task Detail</u> Have students make installation of TV and telephone wiring as resources permit	Assigned reading Passout: Information Sheet Discuss 1. Television system 2. Telephone system 3. National electrical Code Review terms and definitions Test Demonstrate procedure Assign tasks Supervise work Check student's performance	Information Sheet: Teacher prepared Ref. #2 Test: Teacher prepared Assignment sheet: Teacher prepared Materials and tools required to perform tasks

MAJOR BLOCK IV
Residential Wiring

TASK: 1. Install Service Entrance Panel

AIM: The student will be able to determine type and size of service entrance panel and install the SEP in accordance with local and NEC Regulations

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Service Equipment	<u>Related Information</u> I. Service entrance panels A. Purpose B. Circuit-breaker type 1. Operation 2. Advantages 3. Disadvantages C. Fuse-type 1. Operation 2. Advantages 3. Disadvantages D. Construction E. Sizes II. Blueprint reading A. Branch circuit schedules B. SEP location III. Size determination A. Minimum requirements B. Demand factors C. Load calculations D. Load balancing IV. Panel installation A. Location B. Type mount <u>Task Detail</u> 1. Calculate require load 2. Determine type and size SEP 3. Locate SEP 4. Mount cabinet A. Remove cover B. Flush mount C. Surface mount D. Proper height 5. Install box connectors 6. Pull in service from panel to service entrance location	Assigned reading Review NEC and local code regulation Lecture and demonstrate: Show different types and sizes of service entrance panels Review: 1. Blueprint reading 2. Branch circuit-schedules 3. Calculating circuit loads Motivate student(s) Demonstrate procedure assign task Supervise practice check students performance	Ref. #4 Ref. #2 Samples Ref. #7, Alerich, Walter N., <u>Electrical Construction Wiring, American Technical Society, 848 E. 58th St., Chicago, IL 60637</u> Assignment sheets: Teacher prepared Materials and equipment required to perform task

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Service Equipment</u> (Continued)	<u>Task Detail (cont'.)</u> 7. Insert all homerun conductors and tighten box connectors 8. Coil or fasten all cables inside cabinet (can) to protect from damage		

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MAJOR BLOCK IV
Residential wiring

TASK: 2. Install Service Entrance

AIM: The student will be able to locate and install service entrance equipment and conductor in accordance with local and NEC regulations.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Service Equipment	<u>Related Knowledge</u> I. Service drop A. Function B. Location C. Clearance 1. Ground clearance 2. Roof clearance 3. Window clearance D. Power supplier requirements E. Cable 1. Three separate wires 2. Triplex cable 3. Drip loop 4. Aluminum cable 5. Copper cable II. Service drop insulator or insulator rack A. Location B. Installation III. Service head A. Location B. Installation IV. Meter base V. Service entrance conductor VI. Raintight equipment VII. Service entrance conductor VIII. Electrical system grounding A. System and circuit B. Equipment and conductor enclosure <u>Task Detail</u> 1. Fasten meter base to wall <u>Note:</u> Check location and height	Assigned reading Review NEC and local code regulations Lecture and demonstrate Show samples: 1. Service head 2. Meter base 3. Cable 4. Raintight equipment Motivate student(s) Demonstrate procedure Assign task Supervise Practice	Ref. #4 Ref. #2 Ref. #7 Samples Assignment sheet: teacher prepared Materials and equipment required to perform task

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Service Equipment</u> (Continued)	<u>Task Detail (cont')</u> 2. Measure conduit for length, cut and ream 3. Install weatherhead 4. Install box connector 5. Fasten conduit into meter can and to surface 6. Install raintight cap on service switch, insert nipple, fasten to meter base and to surface 7. Pull in conductors and connect as necessary 8. Connect service conductors previously installed from panelboard 9. Install ground wire from service to ground electrode	Check students performance	
	167		168

MAJOR BLOCK IV
Residential wiring

TASK: 1. Install 120 volt receptacles, connect conductors, and install cover plate
AIM: The student will be able to properly select and install receptacles, make correct conductor connection, and properly install cover plate in accordance with NEC and local regulations

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Finish Wiring	<u>Related Knowledge</u> I. Receptacles A. Types 1. Ampere rating 2. Voltage rating 3. Use 4. Configuration B. Construction 1. Split-wire duplex receptacle 2. Back-wired receptacle II. National Electrical Manufacturers Association III. Underwriters laboratory IV. Cable preparation A. Sheath removal B. Wire stripper V. Splice connectors A. Solderless 1. Wire nut connectors 2. Crimped connectors 3. Split-bolt connectors B. Solder <u>Task Detail</u> 1. Remove cable sheath 2. Remove insulation from wires 3. Connect conductors to receptacle A. Brass color terminal for black wire B. Silver color terminal for white wires 4. Connect ground wire	Assigned reading Review NEC and local code regulations Demonstrate and review: 1. Types of receptacles 2. Cable sheath removal 3. Wire stripping 4. Splice connectors and making splice 5. Soldering procedure where applicable Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Ref. #4 Ref. #2 Ref. #7 Assignment sheet: teacher prepared Materials and equipment required to perform task.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Finish Wiring</u> (Continued)	<u>Task Detail (cont')</u> 5. Connect outgoing cable to receptacle if applicable 6. Attach receptacle to box 7. Attach cover plate		

MAJOR BLOCK IV
Residential Wiring

TASK: 2. Connect and install single-pole switch to lighting outlet

AIM: The student will be able to properly select and install a single-pole switch to the source and to the lighting outlet in accordance with NEC and local regulations.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Finish wiring	<u>Related Knowledge</u> I. Switches A. Types 1. Toggle switch 2. Rocker switch 3. Push button 4. Switch and receptacle 5. Switch and pilot light 6. Two switches on one strap 7. Time-delay switch 8. Rotary dimmer switch B. Rating 1. Voltage 2. Amperage 3. AC 4. AC-DC C. Type internal wiring 1. Single-pole switch 2. Three-way switch 3. Four-way switch II. Wiring A. Two wire cable B. Three wire cable III. Blueprint reading <u>Task Detail</u> 1. Connect single-pole switch with source (SEP) A. Connect switch box wiring B. Connect outlet box wiring 2. Connect single-pole switch with lighting outlet	Assigned reading Review NEC and local code regulations Demonstrate and explain 1. Types of switches 2. Use of various switches 3. parts of switch 4. Connection wire to switch terminals Review: 1. Cable and wire preparation 2. Splice connectors 3. Blueprint for switch location, type of switch and lighting outlet Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Ref. #4 Ref. #2 Ref. #7 Sample of switches Assignment sheet: teacher prepared Materials and equipment required to perform task

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Finish wiring</u> (Continued)	A. Connect wiring at light outlet B. Connect wiring at switch 3. Install switch in box 4. Install cover plate 5. Install light fixture		

MAJOR BLOCK IV
Residential wiring

TASK: 3. Connect and install three-way switches to lighting outlet
AIM: The student will be able to explain the operation of the three-way switch; properly select and install three-way switches in a lighting outlet circuit in accordance with NEC and local regulations.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Finish Wiring	<u>Related Knowledge</u> I. Refer to Major Block IV, Minor Block C, Task 2, for related information. II. Cable A. Power source B. Between switches III. Terms A. Hinge point B. Common point C. Traveler wires or switching wires IV. Wiring rules for three-way switches <u>Task Detail</u> <u>Wire three-way switches with lighting outlet</u> 1. Connect wiring in lighting outlet box to source 2. Connect wiring to switch number 1 and box 3. Connect wiring to switch number two and box 4. Install switches in box 5. Install cover plates 6. Install light fixtures	Review: 1. Types of switches 2. Rating of switches 3. Construction of three-way switch 4. Use of three-way switch Demonstrate operation of three-way switches in a circuit Show diagram of wiring circuit Explain terms Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Ref. #4 Ref. #2 Ref. #7 Sample model Chalk board Assignment sheet: teacher performance Materials and equipment required to perform task

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Finish Wiring</u> (Continued)	<u>Task Detail (cont.)</u> <u>Wire three-way switches with lighting outlet between switches</u> 1. Connect wiring in first switch <u>Note:</u> Connect grounding wire 2. Connect wiring to lighting outlet box <u>Note:</u> Connect grounding wire 3. Connect wiring to second switch <u>Note:</u> Connect grounding wire 4. Install switches in box 5. Install cover plates 6. Install light fixture <u>Wire three-way switch with light at end of run</u> 1. Connect wiring in first switch <u>Note:</u> Connect grounding wire 2. Connect wiring in second switch <u>Note:</u> Connect grounding wire 3. Connect wiring to lighting fixture 4. Install switches in box 5. Install cover plates 6. Install light fixture		

MAJOR BLOCK IV
Residential Wiring

TASK: 4. Install a branch circuit with a light circuit with a light operated by one four-way and two three-way switches
AIM: The student will be able to connect a light that is controlled from three locations In accordance with NEC and local codes.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Finish Wiring	<u>Related Knowledge</u> I. Review to Major Block IV, Minor Block C, Task 3, for related information <u>Task Detail</u> 1. Connect wiring in lighting outlet box to source and to light 2. Connect wiring to first switch and box 3. Connect wiring (3-wire cable) to second switch (four-way) and box 4. Connect wiring to third switch and box Note: Connect ground wires at each box. 5. Install boxes and cover plates 6. Install light fixture 7. Connect source and test	Review: 1. Four-way switches 2. Three-way switches 3. Wall and ceiling boxes 4. Use of four-way switches Show diagram of wiring circuit Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Assignment sheet: teacher performance Materials and equipment required to perform task

MAJOR BLOCK IV
Residential Wiring

TASK: 5. Install low voltage systems: buzzers, chimes, and door bells

AIM: The student will be able to install transformers for low voltage system; install switches and connect circuits for doorbells, chimes, and buzzers.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Finish Wiring	<u>Related Knowledge</u> Refer to Major Block IV, Minor Block A, Task 6, "Install low voltage wiring", for related information <u>Task Detail</u> 1. Install transformer A. Mount transformer inside of outlet box B. Make line voltage connections inside box 2. Connect transformer to 120-volt circuit 3. Connect low voltage wiring switches A. Doorbells B. Chimes C. Buzzers 4. Connect wiring to terminal board Note: Used with front and rear bells, buzzers, or chimes 5. Connect source and test	Assigned reading Review: 1. Low voltage wiring system 2. Low voltage circuits 3. National electrical code on low voltage circuits Demonstrate procedure Assign tasks Supervise work Check students performance	Ref. #5 Ref. #2 Assignment sheet: Teacher prepared Materials and tools required to perform task

MAJOR BLOCK V
Low Voltage Remote
 Control Circuits

TASK: 1. Install low voltage control circuit and test

AIM: The student will be able to define terms and explain the operation of the low voltage control circuit; and install circuit consisting of a low voltage transformer, low voltage switch and low voltage relay.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Basic circuiting	<u>Related Knowledge</u> I. Transformers A. Construction B. Action C. Types 1. Step-up transformers 2. Step-down transformers D. Turns ratio II. Low voltage relays A. Operation B. Construction C. Use III. Low voltage switches A. Operation B. Construction C. Use IV. Low voltage remote control systems A. Types B. Circuits V. National electrical code requirements <u>Task Detail</u> 1. Install low voltage transformer 2. Install low voltage relay 3. Install low voltage switch 4. Connect wiring from transformer to relay with switch controlling the relay 5. Apply power to transformer and check voltage at secondary terminal of transformer	Assigned reading Pass out: information sheet Lecture and demonstrate: Define terms Show samples of: 1. Low voltage transformers 2. Low voltage switches 3. Low voltage relays Review NEC and local code requirements Motivate student(s) Demonstrate procedure Assign tasks Supervise work Check students performance	Information sheet: teacher prepared Ref. #5 Ref. #2 Local code Assignment sheet: teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Basic Circuiting</u> (Continued)	<u>Task Detail (cont')</u> 6. Connect ohm meter across line voltage leads. Cut switch on and off. Observe action of ohm meter. 7. Install second switch and connect in parallel with first switch. 8. Operate either switch. Observe action of line voltage contacts through ohm meter action. 9. Install and connect second relay in parallel with first relay. 10. Operate either switch and observe action of line voltage contacts on both relays through ohm meter action.		

MAJOR BLOCK V	TASK: 2. Install and connect one master control switch to control four individual switches		
Low Voltage Remote Control Circuits	AIM: The student will be able to define terms and explain the operation of the master control switch and install circuit consisting of master control switch controlling four light fixtures		
MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
Master Control Switches	<u>Related Knowledge</u> I. Master control switches A. Manual 1. Construction 2. Operation B. Motorized C. Connection with individual switches II. Interconnection of multiple master control stations III. Rectifiers A. Construction B. Operation C. Use <u>Task Detail</u> 1. Examine master control switch <u>Note:</u> Check position of the sliding contacts as knob is turned 2. Install and connect master control switch to four individual lights 3. Install and connect four single pole, double throw switches for individual control of four light switches 4. Install and connect line voltage to light fixtures through the remote control relays and to the transformer	Assigned reading Pass out: Information sheet Define terms Lecture and demonstrate 1. Switch construction 2. Rectifier construction 3. Operation of switches Review NEC and local code requirements Motivate student(s) Demonstrate procedure Assign tasks Supervise work Check students performance	Information sheet: teacher prepared Ref. #5 Ref. #2 local code Assignment sheet: teacher prepared Materials, tools and equipment as required to perform task

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Master Control Switches</u> (Continued)	<u>Task Detail (cont'.)</u> 5. Connect to power source and observe action of individual switches. Note action of the master control switch 6. Install and connect a second master control switch in parallel with the first master control switch 7. Connect to power and observe the action of the individual switches as well as the two master control switches.		

MAJOR BLOCK VI
Commercial And
Industrial Wiring

TASK: 1. Make ninety degree bend with stub
AIM: The student will be able to define EMT; describe construction and size, identify use; measure, cut, ream, and make a ninety degree bend with a stub.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electrical Metallic Tubing	<u>Related Knowledge</u> I. Definition of EMT II. Construction A. Material 1. Aluminum 2. Steel B. Size III. NEC requirements for EMT IV. Cutting EMT A. Hacksaw blade type B. Reaming C. Precautions V. Measurements for bends A. Stub allowance B. Marking EMT VI. Bending A. Maximum bends allowance B. Bending methods 1. Bender inverted 2. EMT on floor C. Type bender 1. Hickey 2. Bench type 3. Hydraulic D. Parts of bender <u>Task Detail</u> 1. Select EMT 2. Measure and cut EMT to length 3. Measure and mark EMT for stub and bend 4. Align tubing mark with back of tubing form on bender 5. Bend EMT to ninety degrees	Assigned reading Show transparencies Lecture and demonstrate Show film: tell student what to look for in film; discuss film; test on film Review lesson Test Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Ref. #7 Transparencies: I. Ed. IV 20T Nos. 110-113 Film: <u>Electrical Work: Installing Conduit</u> , Ref. B, #50080, University of Illinois, Rent Test: <u>Vocational Electrical Trades Technical Information Questions</u> . Assignment sheet: teacher prepared Materials and equipment required to perform task

MAJOR BLOCK VI

Commercial And Industrial Wiring

TASK: 2. Make back to back bend

AIM: The student will be able to identify use of back to back bend and accurately measure and bend to specifications.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electrical Metallic Tubing	<u>Related Knowledge</u> I. Refer to Major Block VI, Minor Block A, Task 1 for related information II. Application A. Connect outlet boxes B. Direction change III. Bending precautions <u>Task Detail</u> 1. Select EMT 2. Make first bend 3. Measure distance between stubs and mark on EMT 4. Reverse tool bending direction 5. Set tools point "A" on mark 6. Make right angle bend 7. Check angle and distance between stubs	Assigned reading Review: 1. NEC requirements 2. Measuring procedures 3. Bend allowances 4. Math Applications Show Transparencies Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Ref. #7 Transparencies: I. Ed. IV 20T Nos. 114-115 Assignment sheet: teacher prepared Materials and equipment required to perform task

MAJOR BLOCK VI

Commercial And Industrial Wiring

TASK: 3. Bend an offset in EMT

AIM: The student will be able to explain where offsets are used and accurately measure and bend EMT offset to specifications.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electrical Metallic Tubing	<u>Related Knowledge</u> I. Types A. Offset B. Saddle II. Application A. Structure material clearance B. Box connection III. Terms A. Throw B. Box offset C. Offset measurement IV. Procedure A. Location of bend starting point B. Location of center lines of EMT C. Position of material D. Angle of bend E. Accuracy check <u>Task Detail</u> 1. Select EMT 2. Measure and cut EMT to length, unless a full length used. 3. Measure and mark EMT for first bend starting point 4. Make first bend <u>Note:</u> Handle of bender will be in vertical position, conduit will be 45°. 5. Reverse the bender and slide along conduit until throw, as measured along the vertical handle, is equal to	Assigned reading Show transparencies Review: 1. NEC requirements 2. Measuring procedures 3. Bend allowance 4. Terms Review procedure	Ref. #7 Transparencies: I. Ed. IV 20T, Nos. 114-115

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Electrical</u> <u>Metallic Tubing</u> (Continued)	<u>Task Detail (cont')</u> 5. Reverse the bender and slide along conduit until throw, as measured along the vertical handle, is equal to the desired amount 6. Set bender handle on floor and make second bend by grasping EMT and bending legs parallel 7. Check accuracy by use of level or measuring with rule	Motivate student(s) Demonstrate procedure Assign task Supervise practice Check student performance	Assignment sheet: teacher prepared Materials and equipment required to perform task

Commercial And
Industrial Wiring

AIM: The student will be able to explain function of a saddle, accurately measure layout for bends, and bend EMT to specifications.

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MAJOR BLOCK VI
Commercial And
Industrial Wiring
TASK: 5. Install branch circuit
AIM: The student will demonstrate ability to install a branch circuit using EMT, by identifying and installing junction boxes, box connectors, couplings, pulling conductors through EMT, and making connection in compliance with NEC regulations

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electrical Metallic Tubing	<u>Related Knowledge</u> I. Box connectors A. Watertight compression B. Indenter type C. EMT set screw II. Couplings A. Watertight compression B. Dry location C. Set screw coupling D. indenter coupling E. Self-locking coupling III. Conductors A. Types B. Size C. Maximum allowed IV. Ampacity reduction factors V. Grounding VI. EMT straps A. Two-hole B. One-hole C. Nail strap VII. Wire pulling equipment A. Fish tape B. Fish tape holder C. Accessories VIII. Wire pulling procedure A. Wire make-up B. Connection to fish tape C. Feeding wire D. Pulling wire E. Coating wires F. Wire allowance 1. Next connection 2. Connection to box G. Safety	Assigned reading Lecture and demonstrate Show samples Review NEC requirements Field trip: explain what to look for Review Test Display wire pulling equipment Demonstrate wire make-up and connection to fish tape	Ref. #7 Sample connectors, couplings, straps, etc. Ref. #2 Field trip: Building site roughed in with EMT Sample equipment

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Electric Metallic Tubing</u> (Continued)	<u>Related Knowledge (cont')</u> VIII. Cost analysis A. Material cost B. Labor cost <u>Task Detail</u> 1. Install junction boxes as in non-metallic sheathed cable 2. Set distribution panel 3. Select size EMT 4. Measure and cut to length EMT <u>Note:</u> Allow for bends 5. Make required bends 6. Attach box connector to one end of conduit and tighten 7. Attach a coupling to other end and tighten 8. Install conduit between two junction boxes and fasten in place 9. Connect conductors to fish tape 10. Insert fish tape and pull in conductors 11. Connect lights, switches and panel and trim out 12. Connect to power and test 13. Make material list and figure time for completion of job	Calculate job cost 1. Material 2. Time 3. Labor Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Assignment sheet: teacher prepared Materials and equipment required to perform task

MAJOR BLOCK VI

Commercial And
Industrial Wiring

TASK: 6. Install service disconnect

AIM: The student will be able to install the correct size and type of disconnect for an office building according to the NEC.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electrical Metallic Tubing	<u>Related Knowledge</u> I. Space needs for service disconnect (height, on each side, and on top) II. Type of disconnect III. Grounding of service IV. Overcurrent protection <u>Task Detail</u> 1. Determine size of disconnect overcurrent protection needed 2. Locate services switch location from blueprints 3. Find correct height to bottom of panel and mark 4. Mount with wood screws 5. Check side and top, with door closed, with level 6. Ground service according to NEC	Motivate student(s) Lecture Illustrate disconnect Chalkboard drawings Models Discussion Oral questions Review Test Motivate student(s) Demonstrate Procedure Assign task Supervise practice Check student performance	Ref. #7 Re. #2 Test: Vocational Electrical Trades Technical Information Questions, pp. 3, 8, 24, 26, 52, 73, 75, 86, 88, 89, 92, 95, 101, 106 Assignment sheet: teacher prepared Materials and equipment as required to perform task

MAJOR BLOCK VI

Commercial And
Industrial Wiring

TASK: 7. Install meter loop and feeders to services switch

AIM: The student will be able to make and install meter loop and feed the service in accordance with NEC specifications.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electrical Metallic Tubing	<u>Related Knowledge</u> - Height of weather head - Size of conduit - Height of meter base <u>Task Detail</u> - Install nipple of correct size from service switch out through finished wall to meter location - Make up correct size meter loop and install it on nipple and strap riser - Pull feeders from meter base to service switch - Make connections - Connect to Ohmmeter and test	Motivate student(s) Lecture and illustrations, pictures from trade magazines, etc. local ordinances on specific heights Guest speaker- Local Electrical Inspector Discussion Review Test Motivate student(s) Demonstrate task Assign task Supervise practice Check student performance	Ref. #7 Ref. #2 Assignment sheet: teacher prepared Materials, tools, and equipment required to perform task

MAJOR BLOCK VI
Commercial And
Industrial Wiring

TASK: 8. Install gutter, lighting, and equipment panels

AIM: The student will be able to install gutter and panels, and make connections of feeders in accordance with NEC.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electrical Metallic Tubing	<u>Task Detail</u> 1. Install gutter under service switch mounted - Note: Use correct size nipple 2. Mount lighting and equipment panels and nipple into gutter. (The bottom of all panels and switches should be the same distance from the gutter.) 3. Bring feeders from load side of service switch into gutter 4. Bring correct size feeders from panels, wire size is determined by size of lugs in panel, into gutter and kerney with load wires from service switch (wire according to diagrams on floor plans) 5. Connect to source and test lugs with voltmeter	Motivate student(s) Field Trip: Tell students what to look for on field trip Discuss field trip Test on field trip Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Field Trip: To building with representative type of insulation Assignment sheet: teacher prepared Materials and equipment as required to perform task

MAJOR BLOCK VI

Commercial And
Industrial Wiring

TASK: 9. Install branch circuits for lights

AIM: The student will be able to install conduit from panels to lights and connect correctly.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electrical Metallic Tubing	<u>Related Knowledge</u> I. Number of lights on a circuit II. Feeder sizes <u>Task Detail</u> 1. Locate lights and switches as specified in blueprints 2. Refer to previous task for installation of lights and switches 3. Connect to source and test	Motivate student(s) Lecture with illustrations Discussion Review NEC regulations Oral questions Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Ref. #4 Ref. #2 Assignment sheet: teacher prepared Materials, tools, and equipment required to perform task

MAJOR BLOCK VI

COMMERCIAL AND
INDUSTRIAL WIRING

TASK: 10. Install Ground Fault Circuit Interrupters (GFCI)

AIM: The student will be able to explain grounding methods and procedures and install a GFCI in the circuit.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Electric Metallic Tubing	<u>Related Knowledge</u> I. Grounding A. System grounding B. Equipment grounding II. Method of grounding A. Ground rods B. Grounding connector C. Equipment ground III. Bonding conduit IV. Overcurrent protection V. Ground fault circuit inter- rupters A. Types B. Sizes C. Installation VI. Feeders A. Number B. Size C. Types <u>Task Detail</u> <u>Permanently Installed Receptacle Type GFCI</u> 1. Read carefully manufacturer's instructions 2. Install GFCI in standard switch box 3. Connect wiring as for standard receptacle 4. Make feed-through connection to other receptacles <u>NOTE:</u> Receptacles must be on same circuit and beyond the unit	Assigned reading Review NEC regulations on grounding Discuss importance of grounding system Discuss and determine outlets from sample blueprint	Ref. #2 Sample blueprint

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Electric Metallic Tubing</u> (Continued)	<u>Task Detail (Con't.)</u> <u>Combination Circuit Breaker Type GFCI</u> 1. Refer to manufacturer's instructions 2. Connect black wire to terminal marked load power 3. Connect white wire to neutral terminal (load neutral) 4. Plug device into SEP clips 5. Connect white pigtail wire to neutral bar 6. Test GFCI		

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MAJOR BLOCK VI
Commercial And
Industrial Wiring

TASK: 1. Make ninety degree bend with stub

AIM: The student will be able to identify different types of rigid conduit, explain its use; and demonstrate skill by measuring, and marking conduit for bend and make a ninety degree bend with specified stub

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Rigid Conduit	<u>Related Knowledge</u> I. Definition of rigid conduit II. Construction A. Material 1. Galvanized 2. Aluminum 3. Black enamel 4. Plastic covered B. Size 1. Length 2. Diameter 3. Wall thickness III. Use IV. Joint preparation A. Cutting 1. Hacksaw 2. Pipe cutter B. Reaming 1. Hand brace 2. Spiral flute reamer C. Threading 1. Ratchet die stock 2. Die a. Types b. Sizes V. Measurements for bend A. Stub allowance B. Thread allowance C. Marking conduit VI. Bending A. Minimum radius 1. With lead sheath 2. Without lead sheath B. Type bender 1. Hickey 2. Bench type 3. Electric-hydraulic C. Safety	Review NEC regulations Show transparencies Lecture and demonstrate Show samples of rigid conduit Review lesson	Ref. #2 Transparencies: I. Ed IV 20T, Nos. 118-119 Sample

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rigid Conduit</u> (Continued)	<u>Task Detail</u> 1. Select rigid conduit for job requirement 2. Measure for bend A. Stub allowance B. Thread allowance C. Allowance for radius of bend 3. Mark conduit for bend point 4. Bend conduit to 90° 5. Check angle of bend and length of stub	Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Assignment sheet: teacher prepared Materials, tools, and equipment as required to perform task

MAJOR BLOCK VI

Commercial And
Industrial Wiring

TASK: 2. Make back to back bend with predetermined distance between stubs

AIM: The student will be able to explain use of back to back bends and accurately layout and bend to specifications

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Rigid Conduit	<u>Related Knowledge</u> I. Refer to Major Block VI, Minor Block B, Task 1 for related information II. Application A. Connect outlet boxes B. Direction change III. Layout A. Bend marks B. Radius allowance C. Between stub distance D. Allignment lines <u>Task Detail</u> 1. Select rigid conduit for job requirement 2. Measure for back to back bends A. Radius allowance B. Thread allowance C. Stub allowance D. Distance between stubs 3. Mark alignment line on opposite sides of conduit 4. Make first bend <u>Note:</u> Check stub length 5. Reverse tool bending direction 6. Make second ninety degree bend <u>Note:</u> Check distance between stubs and stub length 7. Check alignment and angle of stubs	Review: 1. Radius allowance 2. Layout and measuring procedure Lecture and demonstrate Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Assignment sheet: teacher prepared Materials and equipment required to perform task

Commercial And Industrial Wiring

AIM: The student will be able to demonstrate ability to measure, layout, and bend an offset on the end of rigid conduit to specifications.

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MAJOR BLOCK VI

Commercial And
Industrial Wiring

TASK: 4. Make saddle in rigid conduit

AIM: The student will be able to accurately layout bend lines, and bend saddle in rigid conduit to meet job requirements.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Rigid Conduit	<u>Related Knowledge</u> Refer to Major Block VI, Minor Block A, Task 4, "Bend a Saddle in EMT", for related information <u>Task Detail</u> 1. Select type and size conduit for job requirement 2. Layout bend lines <u>Note:</u> Layout bend reference lines to insure alignment 3. Make first bend to required angle 4. Make offset bend the height of required saddle 5. Make second bend to form offset <u>Note:</u> Horizontal runs of conduit should be parallel 6. Make third bend the width of the saddle <u>Note:</u> Bend angle is the same as first bend 7. Complete saddle with fourth bend (offset) 8. Check saddle for: a. Angle of bends	Review: 1. Layout and measurement of bend lines 2. Bend angles A. Size B. Advantages 3. Bending problems A. Uniformity B. Alignment C. Level D. Clearance Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Assignment sheet: teacher prepared Materials, tools and equipment as required to perform task

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rigid Conduit</u> (Continued)	<u>Task Detail (cont')</u> B. Size of saddle height and width C. Saddle for level D. Alignment of conduit run		
229	104		239

MAJOR BLOCK VI

Commercial And
Industrial Wiring

TASK: 5. Bend a ten inch offset in rigid conduit

AIM: The student will be able to measure and bend an offset in rigid conduit according to specifications.

MINOR BLOCK 8	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Rigid Conduit	<u>Task Detail</u> 1. Bend a forty five degree angle with hickey 2. Measure for second bend as when bending an offset in EMT 3. Turn first bend down and put back of hickey on mark for second bend 4. Make second bend and measure the end of the conduit and the back of the first bend. Both should measure the same.	Transparency Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Transparency: <u>I. Ed.</u> <u>IV 20T, No. 120</u> Assignment sheet: teacher prepared Materials, tools, and equipment as required to perform task

MAJOR BLOCK VI
Commercial And
Industrial Wiring

TASK: 6. Install service equipment for commercial spray booth

AIM: The student will be able to install service equipment, to include gutter, lighting and equipment panels, and make connections of the feeders in accordance with NEC requirements.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Rigid Conduit	<u>Related Knowledge</u> I. Refer to Major Block VI, Minor Block B, Task 1, for related information II. Couplings A. Threaded B. Threadless C. Expansion type III. Conduit connecting methods A. Boxes B. Gutters C. Troughs D. Fixtures IV. Explosion-proof installation A. Heavy wall conduit B. Explosion-proof fittings 1. Type 2. How to use 3. When to use V. Conductor capacity VI. Ampacity reduction factor <u>Task Detail</u> 1. Locate service equipment on electrical floor plan 2. Install service switch 3. Install gutter under service switch <u>Note:</u> Use correct nipple 4. Mount lighting and equipment panels <u>Note:</u> The bottom of all panels and switches should be the same distance from the gutter 5. Install nipple from equipment into gutter	Review: 1. Heavy wall construction 2. Size 3. Joint preparation 4. Bending 5. NEC requirements 6. Connecting methods 7. Electrical prints Show Samples 1. Couplings 2. Explosion-proof fittings Lecture and demonstrate Test Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Ref. #2 Samples

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rigid Conduit</u> (Continued)	<u>Task Detail (cont')</u> 6. Install feeders from meter base to service switch 7. Install feeders from load side of service switch to gutter 8. Install feeders to panel from gutter and kerney to feeders from service switch 9. Ground service equipment to proper grounding electrode		
235	107		236

MAJOR BLOCK VI
Commercial And
Industrial Wiring

TASK: 7. Install lights and outlet boxes in commercial spray booth
AIM: The student will be able to locate and install lights and outlets in a commercial spray booth in accordance to NEC requirements

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Rigid Conduit	<u>Related Knowledge</u> Refer to Major Block VI, Minor Block B, Task 6, for related information <u>Task Detail</u> 1. Locate lights from electrical floor plan 2. Install ceiling boxes and conduit for lights 3. Insert fish tape, pull in wiring and make connections in ceiling outlets 4. Install boxes and outlets for machines 5. Install conduit to switches and explosion proof fittings 6. Insert fish tape, pull in wires and make proper connections 7. Trim out and test system for short 8. Pour sealant in EYS fittings 9. Connect to power source, energize system and test for proper operation	Review: 1. Explosion-type fittings 2. Fitting sealants 3. Electrical floor plan 4. NEC regulations Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #2 Assignment sheet: Teacher prepared Materials, tools, and equipment as required to perform task

MAJOR BLOCK VI

Commercial And
Industrial Wiring

TASK: 1. Install branch circuit with light on a single pole switch

AIM: The student will be able to install a circuit in flexible metal conduit in accordance with NEC regulations

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Flexible Metal Conduit	<u>Related Knowledge</u> I. Flexible metal conduit A. Types B. Uses permitted C. Uses not permitted II. Construction III. Installation A. Size 1. Minimum 2. Maximum B. Box connectors 1. Types 2. Installation 3. Locating and marking C. Allowable conductors D. Fittings E. Grounding F. Supports G. Bends H. Cutting <u>Task Detail</u> 1. Locate and mark location of boxes 2. Install boxes in unfinished wall and ceiling 3. Install meter loop with meter base and service switch and connect 4. Install small panel 5. Cut flexible metal conduit to length 6. Removes burrs from inside edge of conduit	Review NEC regulations Assigned readings Lecture and demonstrate Show Samples: 1. Flexible metal conduit 2. Box connectors 3. Fittings Review lesson Test Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #2 Ref. #7 Sample Assignment sheet: teacher prepared Materials, tools and equipment as required to perform task

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Flexible Metal Conduit</u> (Continued)	<u>Task Detail (cont')</u> 7. Install conduit 8. Pull wires into conduit and make proper connections 9. Trim out panel, light, and switch 10. Test system for short or open circuits 11. Connect to power source and test		

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MAJOR BLOCK VI

Commercial And
Industrial Wiring

TASK: 2. Install liquid tight flexible conduit between disconnect and motor

AIM: The student will be able to install liquidtight conduit using correct fittings, between double pole single throw watertight disconnect and motor.

MINOR BLOCK C	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Flexible Metal Conduit	<u>Related Knowledge</u> I. Liquidtight flexible conduit A. Definition B. Uses permitted C. Uses not permitted II. Construction III. Installation A. Size 1. Minimum 2. Maximum B. Box connectors 1. Types 2. Installation 3. Locating and marking C. Allowable connectors D. Fittings E. Supports F. Allowable bends 1. Run of conduit 2. Concealed raceway installation G. Cutting <u>Task Detail</u> 1. Install double pole single throw watertight disconnect close to a 120 volt motor 2. Cut conduit to required length Note: Remove burrs 3. Pull wires into conduit and make proper connections 4. Connect to 120 volt power source and test	Review NEC regulations Assigned reading Lecture and demonstrate Show: 1. Liquidtight flexible conduit 2. Box connectors 3. Fittings Test Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #2 Ref. #3 Sample of items Assignment sheet: teacher prepared Materials, tools, and equipment as required to perform task

MAJOR BLOCK VI
Commercial And
Industrial Wiring

TASK: 1. Install 240 volt single phase branch circuit in rigid non-metallic conduit
AIM: The student will be able to properly install a 240 single phase branch circuit in rigid non-metallic conduit in accordance with NEC regulations

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Rigid Non-Metallic Conduit	<u>Related Knowledge</u> I. Liquidtight flexible non-metallic conduit A. Definition B. Construction C. Types D. Uses 1. Location 2. Conditions 3. Limitations II. Installation A. Size 1. Minimum 2. Maximum B. Allowable conductors C. Boxes and fittings 1. Types 2. Installation D. Expansion joints E. Bends 1. Procedure 2. Allowable bends F. Splices and taps G. Cutting and trimming H. Supports I. Cement J. Threading <u>Task Detail</u> 1. Bend a 12" offset near the end of a length of conduit 2. Apply cement to end of conduit and inside PVC box connector	Review NEC regulations Lecture and demonstrate Show samples: 1. Rigid non-metallic conduit 2. Box connectors 3. Fittings Demonstrate: 1. Cutting and trimming 2. Bending 3. Making up joint 4. Threading Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #2 Sample Assignment sheet: teacher prepared Materials, tools, and equipment as required to perform task

MINOR BLOCK D	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Rigid non-metallic conduit</u> (Continued)	<u>Task Detail (cont')</u> 3. Install box connector on end of conduit 4. Apply cement and install coupling on other end of conduit 5. Install box connector into proper sized knock-out and fasten tightly with bushing 6. Cut six foot length of conduit, ream, and bend a 26" stub 7. Make up joint with cement 8. Thread box connector into the threaded hub of a non-metallic junction box 9. Fasten conduit into box connector and strap in place 10. Insert fish tape and pull in a 240 volt single phase service 11. Makeup splices and install box covers 12. Connect to power source and test with voltmeter		

MAJOR BLOCK VI
**Commercial And
Industrial Wiring**
TASK: 1. Bend conduit on hydraulic conduit bender

AIM: The student will be able to properly assemble hydraulic bender, measure and layout for bend, and accurately and safely bend conduit to required specifications

MINOR BLOCK E	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Hydraulic Conduit Bender	<u>Related Information</u> I. Hydraulic conduit benders A. Types B. Operation C. Construction D. Assembling 1. Bending shoes 2. Hose connections E. Use II. Hydraulic fluid III. Measuring and marking bends A. Stubs B. Offsets C. Saddles D. Back to back bends E. Sweep bends F. One shot bends IV. Safety <u>Task Detail</u> 1. Set up and make short radius bend 2. Set up and make long sweep bend 3. Make 90° bend 4. Make offset bend using one shot bender 5. Make saddle using one shot bender 6. Bend double offset using one shot bender 7. Disassemble hydraulic conduit bender	Review Manual Discuss and demonstrate: 1. Operation 2. Selection of bending shoes 3. Checking and adding hydraulic fluid 4. Measuring, laying out and marking bends Emphasize safety Review lesson Motivate student(s) Demonstrate procedure Assign task Supervise practice Inspect students performance	Manufacturer's manual Assignment sheet: teacher prepared Tools, equipment and materials required to perform task

MAJOR BLOCK VI
**COMMERCIAL AND
INDUSTRIAL WIRING**
TASK: 1. Install A Single Phase Transformer
AIM: The student will be able to identify components, make internal connections for wye and delta connection, change connections to accommodate supply voltage and install single phase transformer.

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Distribution Transformers	<u>Related Knowledge</u> I. Principles of electromagnetism II. Principles of electromagnetic induction III. Transformers A. Operation B. Types 1. Step-up 2. Step-down 3. Oil immersed 4. Dry type C. Construction IV. Computing values A. Voltage, current, turns ratio B. KW and KVA values C. Power factor V. Overcurrent protection VI. Grounding VII. Location of transformer VIII. Mounting of transformer IX. Line pole hardware A. Lightning arrester B. Fuses C. Hot line clamps X. Safety <u>Task Detail</u> Have students perform the following tasks as equipment and facilities permit: 1. Remove cover from dry type and oil filled transformer and identify components	Assigned reading Discuss: Principles of electromagnetism as applicable to transformers Demonstrate and explain transformer construction, parts, and function Demonstrate computation problems Review NEC Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #11, Graham, Kenneth C., <u>Industrial and Commercial Wiring</u>, American Technical Society, 848 E. 58th St., Chicago, IL. 60637 Model or chart Ref. #2 Assignment sheet: Teacher prepared Materials, tools, and equipment required and perform task

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Distribution Transformers</u> (Continued)	<u>Task Detail (Con't.)</u> 2. Make internal connections a. Wye connection b. Delta connection 3. Change tap connections to accommodate supply voltage 4. Install single phase transformer for cross arm mounting 5. Install: a. Lightning arrester b. Fuse cutout c. Hot line clamps d. Additional pole line hardware 6. Connect transformer for delta connection 7. Apply 240 volts to primary side and measure voltage across secondary terminals 8. De-energize and change taps 9. Re-energize and measure voltage across secondary terminals 10. Perform steps 4-9 using wye connection		

MAJOR BLOCK VI
COMMERCIAL AND
INDUSTRIAL WIRING

TASK: 2. Install A Three Phase Transformer

AIM: The student will be able to identify components, construct a three phase bank, install necessary pole line hardware, apply voltage to primary leads and measure voltage at secondary terminals.

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Distribution Transformers	<u>Related Knowledge</u> I. Refer to Major Block VI, Minor Block F, Task 1, for related information II. Three phase transformers A. Banks B. Connections 1. Delta-delta 2. Wye-wye 3. Delta-wye 4. Wye-delta III. Lightning arresters IV. Primary fuses V. Oil circuit breakers VI. Automatic circuit VII. Polarity A. Additive B. Subtractive C. Determination of each VIII. Dielectric test for insulating oil <u>Task Detail</u> Have students perform tasks as facilities and equipment permit. 1. Construct a three phase transformer bank 2. Install pole line hardware 3. Connect transformer bank for each of the following connections: a. Wye-wye b. Delta-delta c. Delta-wye d. Wye-delta	Assigned reading Demonstrate and explain Illustrate connections Discuss lesson Ask questions Test Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #11 Chalkboard Assignment sheet: Teacher prepared Materials, tools, and equipment required to perform task

MINOR BLOCK F	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Distribution Transformers</u> (Continued)	<u>Task Detail (Con't.)</u> 4. Apply 240 volts to primary leads and measure voltage at secondary terminals for each connection		

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MAJOR BLOCK VI
**COMMERCIAL AND
INDUSTRIAL WIRING**
TASK: 1. Install System to Supply Power For A Machine Shop
AIM: The student will be able to explain the bus duct distribution system and install the system where facilities, materials, and equipment are available.

MINOR BLOCK G	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Bus Duct Distribution System	<u>Related Knowledge</u> I. Feeder ducts A. Purpose B. Types C. Construction II. Cable troughs A. Purpose B. Parts C. Fittings III. Electrical raceways A. Purpose B. Types IV. Plug-in bus duct systems A. Purpose B. Types C. Size D. Installation V. Circuit breaker cubicles <u>Task Detail</u> 1. Inspect and identify parts and fittings for ventilated feeder duct 2. Inspect and identify parts and fittings for cable troughs 3. Inspect and identify parts for wiring gutters 4. Inspect and identify parts and fittings for plug-in bus duct 5. Inspect and identify parts and fittings for circuit breaker cubicles	Reading assignment Lecture Discuss and review lesson Pass out information sheet Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #11 Information sheet: Teacher prepared Assignment sheet: Teacher prepared Materials, tools, and equipment required to perform task

MINOR BLOCK G	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Bus Duct Distribution System</u> (Continued)	<u>Task Detail (Con't.)</u> 6. Inspect and identify parts and fittings for unit substations 7. Install a unit substation, ventilated feeder duct, circuit breaker cubicle, and plug-in bus duct 8. Install plug-in breakers 9. Energize circuit and check all components		
261	120		262

MAJOR BLOCK VII
Electric Motors
TASK: 1. Service and troubleshoot split phase - induction run motor

AIM: The student will be able to explain operation and use; identify and explain function of parts; service and troubleshoot motor; disassemble and reassemble motor.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Single Phase Motors	<u>Related Knowledge</u> I. Principles of magnetism A. Permanent magnets B. Electro-magnets C. Rotating magnetic fields II. Single phase motors A. Construction B. Operation C. Characteristics D. Motor identification 1. Name plate data 2. Stator winding data E. Types 1. Split phase 2. Commutator III. Split phase-induction run A. Application B. Characteristics C. Motor parts D. Operation E. Size F. Voltage 1. Single 2. Dual G. Switches H. Starters I. Maintenance 1. Cleaning 2. Lubrication J. Testing <u>Task Detail</u> 1. Disassemble motor	Assigned reading Pass out: information sheet Show transparencies: Discuss lesson Demonstrate and explain: 1. Motor construction and parts 2. Testing motors 3. Inspection of motors 4. Types of motors Review lesson Test	Information sheet: teacher prepared Transparencies: I. Ed. IV 20T, Nos. 65-74 Ref. #8, Rosenberg, Robert, <u>Electric Motor Repair</u>, Holt, Rinehart, and Winston, 383 Madison Ave., N.Y., N.Y. 10017 Ref. #9, Smeaton, Robert W., <u>Motor Application and Maintenance Handbook</u>, McGraw-Hill Book Co., 330 West 42 Street, N.Y., N.Y. 10036 Charts, mockup and or samples Test: teacher prepared

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Single Phase Motor</u> (Continued)	<u>Task Detail (cont')</u> 2. Identify and inspect each part as removed 3. Check windings for ground to housing 4. Clean parts and reassemble motor 5. Check starting and running windings 6. Connect dual voltage motor for low voltage operation 7. Connect dual voltage motor for high voltage operation 8. Connect motor to reverse direction 9. Connect motor to source and check load 10. Test motor for bad bearings a. Ball type b. Sleeve type 11. Remove and replace bearings 12. Test and replace centrifugal switch as required	Motivate student(s) Demonstrate procedure Assign task Supervise Practice Check students performance	Assignment sheet: teacher prepared Materials, tools, and equipment as required to perform task

MAJOR BLOCK VII
Electric Motors

TASK: 2. Service and troubleshoot capacitor type motors
AIM: The student will be able to explain function and use; identify and explain function of parts; service and troubleshoot; disassemble and reassemble capacitor type motors.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Single Phase Motors	<u>Related Knowledge</u> I. Capacitor motor types A. Capacitor start-induction run 1. Characteristics 2. Motor parts 3. Motor operation B. Capacitor start-capacitor run 1. Characteristics 2. Motor parts 3. Operation C. Permanent split capacitor 1. Characteristics 2. Motor parts 3. Operation II. Capacitors A. Construction B. Types 1. Electrolytic 2. Oil filled C. Function D. Rating 1. Voltage 2. MFD Rating E. Eddy currents <u>Task Detail</u> 1. Disassemble motor 2. Identify and inspect parts as removed <u>Note:</u> Mark end plates and frame with center punch to facilitate assembly 3. Check windings for ground to housing	Assigned reading Pass out: information sheet Show transparencies Demonstrate and explain 1. Parts of motor 2. Types of capacitors Discuss lesson Oral questions Review Test Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Information sheet: teacher prepared Transparencies: I. Ed. IV 20T, Nos. 100-105 Ref. #8 Ref. #9 Test: teacher prepared Assignment sheet: teacher prepared Materials, tools, and equipment as required to perform task

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Single Phase Motor</u> (Continued)	<u>Task Detail (cont')</u> 4. Check and test starting and running windings 5. Connect dual voltage motor and test low and high voltage operation 6. Test capacitor(s) <u>Note:</u> Remove and replace as required 7. Connect motor to reverse direction 8. Connect motor to source and check load 9. Test motor for bad bearings, and replace as required 10. Test and replace centrifugal and starting switch		
269			270

MAJOR BLOCK VII
Electric Motor

TASK: 3. Troubleshoot and service repulsion type motor
AIM: The student will be able to explain operation and use; identify and explain function of parts; service and troubleshoot; disassemble and reassemble repulsion type motor.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Single Phase Motors	<u>Related Knowledge</u> I. Repulsion type motors A. Characteristics B. Operation C. Construction D. Application E. Size II. Types of repulsion motor A. Repulsion B. Repulsion-induction C. Repulsion start-capacitor run III. Commutators A. Types 1. Axial 2. Radial B. Turning C. Dressing D. Undercut mica <u>Task Detail</u> 1. Disconnect and clean motor 2. Check bearings for wear 3. Check shaft for freedom of rotation 4. Lubricate according to manufacturer's specifications 5. Inspect wiring 6. Clean starting switch contacts where applicable 7. Inspect and clean brushes 8. Install new brushes seat and adjust tension 9. Inspect, turn, undercut mica and polish commutator	Assigned reading Pass out: information sheet Show transparencies Demonstrate and explain: 1. Motor parts 2. Types and commutators 3. Types of repulsion motors Review lesson Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Information sheet: teacher prepared Transparencies: I. Ed. IV 20T, Nos. 106-109 Sample charts Ref. #8 Ref. #9 Ref. #10 Assignment sheet: teacher prepared Materials, tools, and equipment as required to perform task

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Single Phase Motors</u> (Continued)	<u>Task Detail (cont')</u> 10. Inspect bearings for wear and replace 11. Connect dual voltage motor and test low and high voltage operation 12. Check and set brush ring for motor direction		

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MAJOR BLOCK VII
Electric Motors

TASK: 1. Service and troubleshoot three-phase motor

AIM: The student will be able to explain the operation and application; identify and explain function of parts; service and troubleshoot; disassemble and reassemble three phase motors.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Three Phase Motors	<u>Related Knowledge</u> I. Polyphase motors A. Construction B. Operation C. Characteristics D. Application II. NEMA classifications A. Types B. Characteristics III. Motor terminal connections A. Voltage 1. Dual or single 2. Rating B. Leads 1. Three 2. Nine 3. Twelve C. Connection 1. Wye (Y) 3. Delta (Δ) IV. Power and efficiency V. Phase converters A. Purpose B. Types 1. Static 2. Rotating - transformer C. Advantages and disadvantages <u>Task Detail</u> 1. Disconnect and clean motor 2. Check bearing for wear 3. Check shaft for freedom of rotation 4. Lubricate according to manufacturer's specifications	Assigned reading Pass out: information sheet Show transparencies Demonstrate and explain: 1. Three phase motor operation 2. Comparison between three phase and single phase motor 3. Motor terminal connection Explain and illustrate: 1. Calculation of power and efficiency 2. Phase converters Test Motivate student(s) Demonstrate procedure Assign task Supervise practice Check students performance	Information sheet: teacher prepared Ref. #8 Ref. #9 Ref. #10 Transparencies: I. Ed. IV 20T, Nos. 121-129; and 137-138 Assignment sheet: teacher prepared Materials, tools, and equipment required to perform task

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Three phase motor</u> (Continued)	<u>Task Detail (cont')</u> 5. Inspect wiring 6. Inspect bearings for wear and replace as necessary 7. Check motor windings for continuity and shorts a. Wye connected b. Delta connected c. Single voltage; dual-voltage 8. Reassembly and check operation of motor a. Rotor turns freely b. Winding connected according to wiring diagram c. Check rotation direction; reverse if necessary 9. Connect dual voltage motor and test low and high voltage operation 10. Check operation of motor with one phase disconnected 11. Check motor operation for overload		

MAJOR BLOCK VII
Electric Motors

TASK: 2. Rewind three phase motor

AIM: The student will be able to remove coils and insulation; insulate stator; measure and make coils, install coils and insulation in their proper position; make internal connections; and varnish, bake, and assemble motor.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Three Phase Motors	<u>Related Information</u> I. Winding data A. Coil pitch B. Type connection 1. Star 2. Delta II. Stripping tools III. Insulation A. Type B. Size IV. Coils A. Measuring length B. Wire size V. Varnish A. Types B. Air drying C. Baking VI. Epoxy A. Types B. Use VII. Safety <u>Task Detail</u> 1. Record name plate data 2. Take data on windings A. Type of connections B. Coils per group C. Number of groups D. End-clearance E. Coil length and pitch 3. Remove coils and clean out insulation 4. Determine type and size insulation 5. Insulate stator 6. Measure and make coils in groups	Reading assignment Show transparencies Demonstrate and explain: 1. Obtaining winding data 2. Importance of name plate data 3. Safety involved in varnish Motivate student(s) Demonstrate tasks Assign tasks Supervise practice Check students performance	Ref. #8 Transparencies: I. Ed. IV 20T, Nos. 130-132, 133-138 Assignment sheet: teacher prepared Materials, tools, and equipment as required to perform task

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Three phase motor</u> (Continued)	7. Place coils, insulation and phase paper in their proper position 8. Make internal connections and test for shorts 9. Test for polarity 10. Varnish and bake motor 11. Assemble motor 12. Connect motor to power source and test		
281	130	282	

MAJOR BLOCK VIII
AUTOMATIC CONTROLS

TASK: 1. Control A 110 Volt Split Phase Motor With A Manual Across-The-Line Starter
AIM: The student will be able to connect lines and leads to a manual starter by following instructions on wiring diagram.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Motor Controls	<u>Related Knowledge</u> I. Fundamentals of control II. Manual motor starters A. Types B. Sizes C. Styles D. Selection E. Operation III. Overload protection A. Types B. Selection IV. Maintenance and troubleshooting V. Printing reading A. Electrical control schematics B. Wiring diagrams VI. National Electrical Code requirements <u>Task Detail</u> 1. Install disconnect on surface 2. Install manual across-the-line starter 3. Install wiring and conduit from disconnect 4. Follow diagram on starter for connecting leads 5. Install wiring and conduit to motor 6. Follow diagram in connecting leads from motor 7. Connect to source and test	Assigned Reading Lecture and illustrate: 1. Catalogs 2. Illustrations 3. Mock-ups 4. Real starters Review electrical symbols, schematics, and wiring diagrams Discuss lesson Test Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #12, McIntyre, R.L., <u>Electric Motor Control Fundamentals</u>, McGraw-Hill Book Co., 330 West 42nd St., New York, NY 10036 Assignment sheet: Teacher prepared Materials, tools, and equipment required to perform tasks

MAJOR BLOCK VIII
AUTOMATIC CONTROLS

TASK: 2. Control A Three Phase Motor With A Magnetic Across-The-Line Starter
AIM: The student will be able to connect a magnetic starter and push button station to control three phase motor with a magnetic across-the-line starter.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Motor Controls	<u>Related Knowledge</u> I. Magnetic starters A. Construction B. Operation C. Types 1. Styles 2. Sizes II. Overload protection A. Function B. Types C. Selection III. Controls A. Two wire B. Three wire IV. Reversing magnetic starters A. Mechanical B. Electrical V. A-C combination starters A. Construction B. Use VI. NEC motor control requirements VII. Maintenance and troubleshooting <u>Task Detail</u> 1. Refer to previous task for basic installation 2. Mount push-button station a short distance from starter 3. Connect push-button station to terminals 1, 2, and 3 on starter, with conduit and control wire	Assigned reading Lecture and illustrate: 1. Construction of starters 2. Parts of starters 3. Line/load terminals 4. Controls Ask questions Review lesson Test Motivate student(s) Demonstrate procedure Assign tasks Supervise practice Check students performance	Ref. #12 Assignment sheet: Teacher prepared Materials, tools, and equipment required to perform tasks

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Motor Controls</u> (Continued)	<u>Task Details (Con't.)</u> 4. Connect to source and test 5. Draw a wiring diagram and schematic of the task		

MAJOR BLOCK VIII
AUTOMATIC CONTROLS

TASK: 3. Control A 220 Volt Split Phase Motor With a Drum Switch
AIM: The student will be able to wire a split phase motor so that the rotation can be reversed with the switch.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Motor Controls	<u>Related Knowledge</u> I. Operation of a drum switch II. Draw a diagram of the connections for the task III. Uses of a drum switch <u>Task Detail</u> 1. Mount disconnect and drum switch 2. Install wiring and conduit from disconnect to drum switch and from motor to drum switch 3. Connect to source and test	Motivate student(s) Discussion Illustrate drum switch Chalkboard drawings Assignments Test Motivate student(s) Demonstration of task Task assignment Practice on task Performance test	Ref. #11

MAJOR BLOCK VIII

AUTOMATIC CONTROLS

TASK: 4. Control A Three Phase Motor With A Reversing Starter

AIM: The student will be able to construct an electrically interlocked reversing starter and wire it to controll a three phase motor.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Motor Controls	<u>Related Knowledge</u> I. Operation of forward-reverse-stop stations with interlocking devices II. Purpose of interlocks III. Diagram of connections of lines and leads in reversing starters <u>Task Detail</u> 1. Mount three pole disconnect and open type starters 2. Install open wiring from disconnect to L1, L2, L3 of starter #1. Install open wiring from L1, L2, L3 on starter #2, make sure to reverse any two of these lines. 3. Connect control wires from forward, reverse stop station to starters 4. Connect leads and install to motor 5. Connect to power source and test	Motivate student(s) Discussion Illustrate interlocks Chalkboard drawings Students copy in notebooks Oral questions Test Motivate student(s) Demonstration of task Refer to diagram Task assignment Practice on task Performance test	Ref. #8 Ref. #11

MAJOR BLOCK VIII
AUTOMATIC CONTROLS

TASK: 5. Control A Wound Rotor Motor With A Rheostat Type Starter
AIM: The student will be able to connect a motor to a resistance starter that will control speed.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Motor Controls	<u>Related Knowledge</u> I. Operation of a rheostat II. Need for resistance starters III. Diagram of task <u>Task Detail</u> 1. Install three phase disconnect and rheostat starter 2. Connect lines and leads in conduit according to diagram 3. Connect to source and test	Motivate student(s) Discussion Illustrate operation of a rheostat Chalkboard drawings Oral questions Minor Block test Motivate student(s) Demonstration of tasks Oral questions Task assignment Practice on task Performance test	Ref. #8

MAJOR BLOCK VIII
AUTOMATIC CONTROLS

TASK: 1. Build Logic Circuit

AIM: The student will be able to draw a logic diagram and add to it until it has been drawn and an explanation can be given as to how a static control circuit works.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Static Controls	<u>Related Knowledge</u> I. Fundamentals of static controls II. Use a signal converters III. Logic circuit symbols IV. Logic English V. Uses and needs for logic circuits <u>Task Detail</u> 1. Draw basic AND circuit to operate a relay 2. Add an OR element 3. Add an AND NOT element 4. Add a NOT element 5. Add MEMORY and DELAY elements 6. Build circuits from basic training aids	Motivate student(s) Lecture and illustrations Programmed instruction available through Square D Company Oral questions Discussion Supervised study Review Major Block Test Motivate student(s) Demonstration of task Aids available through General Electric and can be bought through a GE supplier Task assignment Practice on task Performance test	Ref. #10 Ref. #10

MAJOR BLOCK IX
Entrepreneurship

TASK: 1. Free Enterprise

AIM: The student will be able to define (describe) our economic system and compare it with other major economic systems. The student will further be able to explain the basis of our economics, list the primary factors of production, and identify the important groups in our economic system.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Economic Systems	<u>Related Knowledge</u> I. The rise of economic systems A. Dawn of civilization B. Discovery of tools C. Specialization/division of labor D. Industrialization E. Trade development II. Standard of living A. How well off people of a society are B. Synonymous with "economy" C. Measured by dividing total production by population III. Factors of production A. Land (resources) B. Labor (people) C. Capital (money invested) D. Technology (education; know-how) IV. Basic questions every economic system must answer A. What goods and services are to be produced? B. Who shall produce them? C. How shall they be produced? D. For whom shall they be produced? V. Basis of free enterprise A. Private property B. Private enterprise C. Freedom of choice VI. Major types of economic systems today	Lecture/discussion Discuss: History and background that gave rise to economic systems Define: Standard of living; how it is measured	Sup. Ref. R. Woodburn, Clint H., <u>An Introduction to Vocational Industrial Education</u>, Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, Texas 77843

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Economic Systems</u> (Continued)	<u>Related Knowledge (cont')</u> A. Pure capitalism B. Modified capitalism C. Socialism D. Communism VII. Pure capitalism A. Exists in theory only B. Individuals afforded liberties basic to free enterprise 1. People determine kinds of goods and services 2. No government control VIII. Modified capitalism A. Laws regulate business activities to protect the people 1. Economic freedoms stated 2. Prevents monopolies B. Public determines product (supply and demand) C. Promotes finding better way (new products) D. Stresses importance of individual 1. Occupational choice 2. Personal incentive 3. Private ownership E. Competition controls quality; price IX. Socialism A. Government controls major industries 1. Transportation 2. Communication 3. Power and utilities B. Secondary industry private ownership	Explain: Laws protect the people; limited natural resources	

MAJOR BLOCK IX
Entrepreneurship

TASK: 2. Forms of business ownership

AIM: The student will be able to identify and describe the different forms of business ownership actively engaged within the free enterprise system.

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Economic Systems	<u>Related Knowledge</u> I. Sole proprietorship A. Owned and controlled by one individual B. Most common form of business ownership in America (75%) C. Mostly small-medium sized D. Advantages 1. Fewer restrictions for starting/terminating venture 2. Sole decision maker 3. Easier to manage 4. All profits belong to owner 5. Simpler tax structure 6. High credit standing II. Partnerships A. General partners 1. Have equal and unlimited liability 2. All partners active in firms operation B. Limited partners 1. One dominant partner assumes unlimited liability; is the decision maker 2. Other limit liability to amount of money they invest C. Silent partner 1. Known as a partner 2. Takes no active part in management D. Nominal partner	Lecture/ discussion Recite: Examples of each form in the community; state	Sup. Ref. #S, Woodburn, Clint H., <u>Entrepreneurship - The Art of Business Ownership</u>, Vocational Instructional Services, F.E. Box 182, Texas A&M University, College Station, Texas 77843. 1984

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Economic Systems</u> (Continued)	<u>Related Knowledge (cont')</u> 1. Lends name to venture 2. Makes no investment nor assists in operation E. Advantages of partnership 1. Increased source of capital and credit 2. Improved decision making potential 3. Better possibilities for expansion and growth III. Joint venture A. Partnership created for particular purpose B. Partnership dissolved when objective is accomplished C. Advantages 1. Increases power of bidding and acquiring contracts IV. Syndicates A. Resemble both general partnership and joint venture B. Organize to conduct financial transaction. C. Advantages 1. Increases buying power 2. Beneficial to small business with mutual needs V. Unincorporated associations A. Most often used by non-profit organizations B. Exist to provide services to members C. Annual dues; fees levied membership financing		

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Economic Systems</u> (Continued)	<u>Related Knowledge (cont'.)</u> D. Examples 1. Credit associations 2. Fraternal organization 3. Charities VI. Corporations A. Usually outgrown of other forms of ownership B. Largest of all forms of ownership C. Multi-owners called stockholders D. Regarded as an artifical being with 1. Right to enter contracts 2. Conduct business in own name E. Must file for and recieve corporate charter to do business F. Charter defines: 1. Type of business 2. Number of shares of stock 3. Basis of corporate structure G. Corporate organization 1. Stockholders (owners) 2. Board of directors (policy makers) 3. President (head) 4. Corporate officers (division heads) 5. Managers 6. Supervisors 7. Workers H. Advantages 1. Indefinite life	Guest speaker; "Free Enterprise"	Guest speaker: Civic leader

MINOR BLOCK A	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Economic Systems</u> (Continued)	<u>Related Knowledge (cont.)</u> 2. Limited liability 3. Ease of ownership transfer 4. Growth potential 5. Managerial efficiency <u>Task Detail</u> 1. Design a questionnaire in preparation of interviewing owners of local businesses 2. Select and interview a local business owner 3. Compare results of interview in class	Questions and answer session	

MAJOR BLOCK IX
Entrepreneurship

TASK: 1. Becoming an entrepreneur

AIM: The student will be able to describe entrepreneurship; identify many risks and responsibilities in starting a business; and weigh the advantages/disadvantages of business ownership.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Going into Business	<u>Related Knowledge</u> I. Facts about entrepreneurship in U.S. A. One of every eight persons on labor force is B. 10.8 million of country's 88 million labor force are single owner small businesses C. 87% of total business operations are small 1. Over 10 million have annual sales under \$100,000.00 2. 7½ million single owner business show receipts less than \$25,000.00 II. Personal traits characteristic entrepreneurs A. Passion to achieve 1. Pride of achievement 2. Leave personal, last-mark 3. Make name for self 4. Aspire to fame B. Urge to be boss 1. Independence motivation stronger than security 2. Desire to plot own course C. Self-confidence 1. Expects and desires role of decision maker 2. Delights in facing problems and making decisions	Lecture/discussion Explain: Role small business plays in american economy	Sup. Re. #S, Woodburn, Clint H., <u>Development of Professional Attitudes</u>, Vocational Instructional Services, Texas A&M University, F.E. Box 182, College Station, Texas 77843

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Going into Business</u> (Continued)	<u>Related Knowledge (cont.)</u> D. Energy (Physical stamina) E. Determination F. Versatility and adaptability III. Advantages of entrepreneurship A. Fills important basic needs to 1. Achieve 2. Meet challenge; make decisions 3. Demonstrate creativity; individuality B. Opportunity to develop close relationship with: 1. Customers 2. Employees C. Pride and prestige of ownership D. Unlimited financial growth potential IV. Disadvantages of entrepreneurship A. Long work hours B. Risk of financial loss C. Burdens often heavy on family D. Contend with confines of regulatory agencies	Class discussion: Advantages/disadvantages (instructor guide discussion) List: Advantages/disadvantages on chalkboard	

MINOR BLOCK	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Going into Business</u> (Continued)	<u>Related Knowledge (con't.)</u> V. Necessary skills of entrepreneur A. Ability to plan - set goals B. Ability to organize - means of attaining goals C. Ability to control - cause people to do things productively	Discuss: Necessary skills of an entrepreneur	

MAJOR BLOCK IX
Entrepreneurship

TASK: 2. Loans, finance, and credit

AIM: The student will be able to define secured and unsecured loan, collateral and lines of credit. The student will also be capable of properly writing a personal check and balancing a personal checking account.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Going into Business	<u>Related Knowledge</u> I. Types of loans A. Unsecured loan 1. Promissory note 2. Called signature loan 3. Requires no collateral B. Secured loan 1. Formally written 2. Specifies terms; interest 3. Requires collateral II. Sources of loans A. Personal savings B. Family; friends C. Banks; trust companies D. Credit unions E. Government III. Forms of collateral A. Real estate B. Insurance policies C. Pledge companies assets IV. Lines of credit A. Personal reputation 1. Honesty 2. Integrity B. Credity ratings 1. Better Business Bureau 2. Banks 3. Charge accounts V. Terms and interest A. Terms - conditions of loan 1. Amount of loan 2. Length of loan 3. Interest rate charged 4. How loan is to be repaid 5. Guarantees	Lecture/discussion Define: Collateral List: Examples Discuss: Credit; importance of "good credit"; honesty; integrity Explain: Simple interest Compound interest Principal Unpaid balance	Sup. Ref. #S Guest speaker: Loan officer, local bank

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Going into Business</u> (Continued)	<u>Related Knowledge (cont.)</u> B. Interest - charge for loan 1. Simple 2. Compound 3. Principal 4. Unpaid balance VI. Banking A. Accounts 1. Checking account 2. Passbook savings 3. Certificates of saving B. Balancing books 1. Deposits 2. With draws 3. Service charges C. Writing checks <u>Task Detail</u> Practice check writing and account balancing	Illustrate: On chalkboard Review	

MAJOR BLOCK IX
Entrepreneurship

TASK: 3. Contracts

AIM: The student will be able to list the ingredients of a contract and explain what constitutes a valid contract, invalid contract, and breach of contract.

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES & AIDS
Going into Business	<u>Related Knowledge</u> I. The American Legal System A. Constitution basis 1. Defines laws "rules of the game" within which individuals; business must operate 2. Establishes system by which these laws are governed B. Two main sources of law 1. Statutory law (written law) enactments of government 2. Common law (unwritten law) based on court decisions II. Nature of business law A. Provides orderly conduct of business affairs B. Provides settlement of any disputes arising C. Contract law is one of the most important areas of business law D. Everyone, every business, enters into contracts of some sort III. Ingredients of a contract A. Voluntary agreement 1. There must be an offer 2. Offer must be accepted 3. Agreement must be voluntary B. Competent parties	Lecture/ discussion Discuss: History and background of the American Legal System Describe: The two main sources of law in the United States Explain: The nature of business law in the United States Guest speaker: "Contracts" List: Ingredients of a contract Define: Legally competent,	Sup. Ref. #S Guest speaker: City attorney, lawyer

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Going into Business</u> (Continued)	<u>Related Knowledge (cont'.)</u> 1. Parties to agreement must be legally qualified 2. Insane persons, convicts, drunkards, minors, are not regarded legally qualified C. Consideration 1. Must be present for contract to be binding 2. Consideration is something of value received by one party or given up by another D. Lawful act - within the law IV. Forms of a contract A. Verbal 1. Parties simply agree among themselves as to terms, conditions 2. Verbal contracts generally will not hold up in a court of law B. Written 1. Spells out all terms and considerations 2. Agreement signed and witnessed V. Types of contracts A. Fixed B. Cost plus fixed fee C. Cost plus percentage of cost D. Index E. General conditions F. Specifications VI. Contract format	Define: Legally competent, Consideration, Lawful act Present: Examples to the class for discussion Pass out: Sample contract Discussion of terms	Pass out: Teacher prepared

MINOR BLOCK B	INFORMATION & TASK DETAIL	SUGGESTIONS FOR TEACHING	REFERENCES AND AIDS
<u>Going into Business</u> (Continued)	<u>Related Knowledge (cont'.)</u> A. Cover B. Bid forms C. Instructions to bidder D. Index E. General conditions F. Specifications VII. Clauses to avoid VIII. Breach of contract A. Failure of one party to honor all terms of agreements B. Grounds for lawsuit 1. Plaintiff - person instituting lawsuit 2. Defendant - person against whom action is brought IX. Penalties A. Damages and delays B. Performance bonds	Quiz	
325	152	326	

APPENDIX

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DEVELOPING A FUNCTIONAL COURSE OF STUDY

The trade and industrial teacher should carefully study the objectives of the local school, the objectives of trade and industrial education and the content that should be included in the trade and industrial course of study. The teacher should then select the content and write behavioral objectives which will have a definite relationship to the course. Each objective should be analyzed as to the activity which can be provided to promote its development. The objectives are then accepted or rejected on the basis of facilities available to place the activity into operation. (See Appendix page 160 for a partial list of items that may be used in developing specific objectives for the development of abilities, attitudes and appreciations.)

When selecting the course content for a functional course of study, the trade and industrial teacher should carefully consider each of the following:

1. Provide for the development of skills in all basic processes inherent in the occupation involved.
2. Provide student experiences in the interpretation and use of fundamental factual information basic to the occupation and to the success of the student.
3. Provide experiences in related science, mathematics, blueprint reading and shop sketching and other subjects or topics related to the occupation.
4. Provide learning experiences regarding hazards, benefits, joys, and sorrows connected with a chosen occupation.
5. Provide experiences which will enable students to take their place in life and fulfill their life's needs as an enlightened citizen and worker.
6. Provide learning experiences whereby students are enabled to see their prospective occupation in relationship to management, labor and the professions.

PROFESSIONAL SERVICES

Texas local school administrators and local school supervisors may obtain the services of state specialists, vocational industrial teacher educators and vocational industrial personnel of Vocational Industrial Services to assist the teacher with the development of the complete course of study. This professional service is available on written request to the Associate Commissioner for Occupational Education, Texas Education Agency, Austin, Texas 78711.

A SUGGESTED LIST OF ITEMS THAT SHOULD BE INCLUDED IN WRITING SPECIFIC OBJECTIVES
FOR THE DEVELOPMENT OF ABILITIES, DESIRABLE ATTITUDES, AND APPRECIATIONS

Related technical information	Open-minded and receptive to change
Basic manipulative tasks	A sense of balance and proportion
Good work habits	A high quality of workmanship
Good safety habits	Needs of others
Problem solving	A willingness to do more than minimum
Administering first aid	Workmanship having recognized value
Make working sketches	Respect for authority
Make good use of library	Rise above failure
Ability to communicate	Overcome boredom
Ability to talk effectively	Value of time
Leadership skills	Speak up in defense of principles
Reading skills	A willingness to accept assignment
Understand everyday science	Reliability-dependability to deliver
The value of other courses	Value of experience
Basic economics, business & management	Value of speed in production
State & national issues, related to occupation	Value of the tools of the trade
Keeping up to date	Clean-safe work areas
Civic needs of the community	Ability to plan work effectively
Adapt to changes in technology	Employee-employer relations
Relate work to manpower situation	Understand the democratic society
Pride in a job well done	Individual initiative and responsibility
Live harmoniously with others	Values of moral conduct and ethical living
Broad aspects of work-trends-factors	Our standard of living
Professional trade associations	Important people in this field
Goals of vocational & technical education	Mass production
Social Security and benefits	Legislation (related)
Free enterprise system	History of the industry
Techniques of job application	Conservation
Recognize hazards and remove them	Listening effectively
True meaning of loyalty to trade and to self	

ACTIVITIES SHOULD BE PROVIDED TO PROMOTE THE DEVELOPMENT OF EACH ITEM

METHODS OF TEACHING

METHOD	DESCRIPTION	ADVANTAGES	DISADVANTAGES	WHEN TO USE
1. LECTURE	Transferring information verbally. An explanation of the teaching points of each topic	Ability to handle large groups Ability to utilize radio Easy to provide facilities	Limits type of subjects Limits chance to learn Liable to confuse learner Can't measure efficiency	To impart new information To supplement other methods
2. ILLUSTRATION	Use of pictures, charts, maps, sketches, models, films, chalkboard	Brings out hidden features Learn by seeing Good substitution for demonstration Cheaper than demonstration	Sometimes hard to get Doesn't always teach what you want Eliminates teaching for doing ability	Profitable supplement to any other method As a substitute for demonstration
3. DEMONSTRATION	Actually doing the job step by step, explaining the how and why of each step	Builds confidence in instructor Proves information reliable More nearly affords complete learning	Lack of suitable place Lack of suitable equipment Excessive cost Takes time Limits size of class	Instructing for doing ability To supplement other methods
4. CONFERENCE	Drawing information from group and through discussion arrive at conclusion	Uses group experience Brings out best point of experience for new ideas Every man has chance	Experience of group Lack of trained leaders Conference may get out of control Takes a lot of time	Instructing for improved practices To reach conclusions Supplement to other methods
5. QUESTIONS & ANSWERS	Key questions planned by instructor on subject matter of lesson -- tie-in with other lessons -- review of previous lesson -- application of lesson	To promote thinking To review Emphasize key points To promote individual participation Helps in developing understanding	Requires time and thought on part of instructor to select and frame good questions Sometimes used to kill time May allow some students to do all the talking if not properly directed	To review & tie-in preceding lesson Before concluding a lesson to review and emphasize major points To bring in experience of class members use with all methods

METHOD	DESCRIPTION	ADVANTAGES	DISADVANTAGES	WHEN TO USE
6. PRACTICE	If skill is to be developed Learner practices performance of skill under close supervision	Develops performance skill	Danger of improper supervision	After instructor demonstrates a doing job the learner should always practice doing the job under supervision of the instructor
7. DRILL	If information is to be understood Learner reviews and repeats main points of information or problem solving until he has it mastered and understands it.	Helps master and retain points of information	Danger of improper supervision	After the instructor has presented an informational lesson with proper teaching aids and explanation, the opportunity to discuss, review or use the information is provided